



**WESTERN LIGHTNING -ECL
WESTERN LIGHTNING PLUS -ECL**

**Enhanced Chemiluminescence Substrate
for Western Blotting**

NEL100001EA: Standard sensitivity, 130 ml

NEL101001EA: Standard sensitivity, 340 ml

NEL102001EA: Standard sensitivity, 680 ml

NEL103001EA: High sensitivity, 130 ml

NEL103E001EA: High sensitivity, 30 ml

NEL104001EA: High sensitivity, 340 ml

NEL105001EA: High sensitivity, 680 ml

For Laboratory Use

CAUTION: A research chemical for research purposes only

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I. INTENDED USE

Western Lightning –ECL and Western Lightning Plus –ECL is a non-radioactive light-emitting system designed to detect proteins immobilized on a membrane. The method provides sensitivity of 1 - 10 pg of protein. Optimal results are attained by using BioMax® Light or X-OMAT Blue film, or the Geliance™ Imaging Systems for documentation. Membranes may be stripped and reprobed if stored wet between uses.

II. PRINCIPLE OF THE PROCEDURE

Western Lightning –ECL chemistry (standard and Plus) is based on an enhanced version of a chemiluminescence reaction in which the enzyme horseradish peroxidase (HRP) catalyzes light emission from the oxidation of luminol. Use of an enhancer increases the emission approximately 1000-fold.¹

In Western blotting, complex mixtures of proteins are separated by electrophoresis and transferred to a membrane (such as PolyScreen® PVDF or Protran® Nitrocellulose) for immunological detection. Antibodies labeled with horseradish peroxidase (HRP) are incubated directly or indirectly with the immobilized protein antigen. Following addition of the Western Lightning –ECL to the membrane, oxidative degradation of luminol occurs, resulting in light emission at a wavelength of 428 nm. This light is captured on film or an imaging system.

III. REAGENTS

Brown Bottle: Enhanced Luminol Reagent.

White Bottle: Oxidizing Reagent.

NEL100 contains 65 ml of each reagent

NEL101 contains 170 ml of each reagent

NEL102 contains 2 x 170 ml of each reagent

NEL103 contains 65 ml of each reagent

NEL103E contains 15 ml of each reagent

NEL104 contains 170 ml of each reagent

NEL105 contains 2 x 170 ml of each reagent.

IV. STORAGE RECOMMENDATIONS

Upon arrival both reagents should be stored at 2° - 8°C.

V. PRECAUTIONS

A. Safety Considerations

Wear disposable gloves and safety glasses while working with reagents, and thoroughly wash hands after handling. Do not eat, smoke or drink in areas in which reagents are handles. Refer to product labels and Material Safety Data Sheet (s) for additional information as appropriate.

B. Performance Considerations

1. These reagents have been formulated and are quality-controlled specifically to detect proteins in Western blots.
FOR LABORATORY USE.
2. Western Lightning –ECL and Western Lightning Plus –ECL have been formulated for use on PVDF and nitrocellulose membranes.
3. Some components of the luminol or oxidizing reagents may precipitate if the product freezes during shipping. Mix moderately with a gentle swirling motion to ensure that all components are in solution.
4. Do not use kit components beyond the expiration date. This date is printed on the kit label.
5. Do not substitute reagents from other kits. Reagents have been optimized for performance with each kit lot. Dilution or other alteration of reagents may result in undesirable modifications of performance, such as loss of sensitivity.
6. Do not allow the membrane(s) to dry out after the primary antibody is added.
7. Proper blocking and washing of membranes is critical for optimum results. The recommended blocking and washing conditions should be tried first and adjusted as necessary for a particular

- application.
8. Prepare the Chemiluminescence Reagent immediately before use. Prepare only enough for the membranes being processed. Discard any excess.
 9. Do not interchange bottle caps; this will lead to cross-contamination of reagents. Designate specific containers for specific reagents, and use clean pipettes or pipette tips for each reagent.
 10. Developing a first film after 30 seconds of exposure allows an estimation of the optimum exposure time to use. (Exposure time can vary from 30 seconds to 2 hours.)
 11. Except for film exposure and development, all steps can be performed outside the darkroom.
 12. A method of stripping the antibodies and re-probing the membrane has been reported.² The stripping procedure can be found in Appendix. Chemiluminescence is well-suited for this application because unlike chromogenic formats you need not remove the substrate from the membrane.

VI. PROCEDURES

A. Membrane Preparation

1. Western blots are prepared following the researcher's current protocol (see Appendix A). Blocking agents appropriate for the solid phase must be employed. The researcher can use a number of methods of introducing the HRP reporter enzyme. For example, an anti-analyte-HRP conjugate, or a secondary reporter such as an anti-rabbit- or anti-mouse IgG-HRP conjugate can be used. The system will also work with biotinylated antibody/streptavidin-HRP or hapten/anti-hapten-HRP systems.
2. Careful rinsing and washing are required to reduce background. See the Reagent Formulation section for a suggested Wash Buffer. After the HRP reporter incubation step, the membranes should be rinsed twice in Wash Buffer followed by one 15-minute and four 5-minute washes with Wash Buffer. All steps are performed at room temperature.

B. Chemiluminescence Reagent Preparation

1. Prepare the Chemiluminescence Reagent by mixing equal volumes from Bottle 1 and Bottle 2 immediately before use. For optimum results, the Chemiluminescence Reagent should be used as soon as possible after mixing. Mix no more than is needed at one time.
2. Incubate the Chemiluminescence Reagent with the membrane for 1 minute at room temperature. Use 0.125 ml per cm² membrane and incubate with gentle agitation.

C. Protein Visualization

1. It is important to keep the film dry. To drain excess Chemiluminescence Reagent, hold the blot vertically and touch it against tissue paper, or blot it between two sheets of Whatman® 3MM filter paper.
2. Place the membrane between the covers of a polypropylene sheet protector with the black interleaf removed (e.g., Boise Cascade Catalog Number L2-A8112). Gently smooth out any air pockets.
3. Place the membrane, protein side up, in the film cassette.
4. Switch off the lights and carefully place the film on top of the membrane.
5. Expose the film for 30 seconds, and then develop.
6. Repeat the film exposure, varying the time as needed for optimal detection.

VII. REAGENT PREPARATION

10X Phosphate Buffered Saline (10X PBS)

For 1 liter:

NaH ₂ PO ₄ .H ₂ O	2.03 g
Na ₂ HPO ₄	11.49 g
NaCl	85 g

The pH of the 10X solution is 6.7 to 6.9. The pH of the 1X solution should be 7.3 to 7.5 (if not, adjust the 1X).

Storage: Room Temperature.

Alternately, Dulbecco's Phosphate Buffered Saline without calcium chloride or magnesium chloride (available from commercial sources), or Tris-based buffers may be used.

10X PBS-TWEEN® 20 (10X PBS-T)

For 1 liter:

10X PBS	995 ml
TWEEN® 20	5 ml

A preservative such as thimerosal (1 g/L) may be added to prolong the life of the reagent. Do not use sodium azide because it inhibits HRP activity.

Storage: Room Temperature.

PBST

For 1 liter:

10X PBS-T	100 ml
dH ₂ O	900 ml
Storage:	Room Temperature

Membrane Blocking Reagent (5% Non-Fat Dry Milk)

For 100 ml:

Carnation™ Instant

Non-Fat Dry Milk 5 g
PBST 100 ml

If additional blocking capability is desired, this reagent may be supplemented with normal serum of the same type as the antibody. Casein or BSA may be substituted for the non-fat dry milk. This reagent should be made up fresh for every use.

Antibody Diluent (1% BSA/PBST)

For 1 liter:

10X PBST 100 ml
H₂O 800 ml
BSA 10 g

Adjust the pH to 7.4, add H₂O to 1 liter, and filter through a 0.22 μ m membrane.

Storage: 4°C

VIII. TROUBLESHOOTING GUIDE

Problem	Possible Cause	Remedy
No signal or weak signal	Poor transfer of proteins	Check gel, Use Colored MW Markers. Use correct pore size membrane*
	Detergents, SDS, exhibit poor binding of low MW proteins	Remove SDS whenever possible
	Membrane preparation inadequate	Check proper membrane hydration Alcohol—Water--Buffer
	Primary or secondary antibody concentration too low or inactive	Titrate antibody conjugates for optimum concentrations or make up fresh
	Wrong Blocking Reagent	Test Blocking reagents with proteins for non affinity
	Azide inhibiting HRP activity	Use only azide-free reagents
	Chemiluminescence reagent improperly prepared	Add HRP conjugate to reagent and look for visible light in a darkroom
Excess signal/Non Specific Binding	Precipitation of components in luminol or oxidizing solutions because of freezing	Mix moderately to ensure that all components are in solution
	Antigen or antibody excess	Adjust concentrations by optimization experiments
High Background	Antigen or antibody excess	Adjust concentrations by optimization experiments

Problem	Possible Cause	Remedy
	Cross Reactivity of Blocking Reagent & Antibody	Test blocking buffers or use Tween-20 in Wash Buffer
	Overexposure to film	Shorter film exposure or let signal decay for 10-15 minutes and repeat exposure
	Membrane dried out during incubation	Use enough reagent to keep membrane wet
	Poor quality antibodies	Use good quality affinity purified Abs.
White Bands "Antibands"	Blank bands on film caused by depletion of chemiluminescence substrate at sites of excess antigen and/or antibody	Reduce concentration of the secondary HRP labeled antibody
"Blotchy" Blot	Fingerprints/Metal forceps/Gloves	Use powder free gloves and avoid touching or folding the membranes
Speckled background	Blocking Reagent	Filter using 0.45 μm aqueous filter
	Secondary HRP conjugated Ab	Spin for 10-20 seconds. Use supernatant

* **Proteins >20 kD use a 0.45 m membrane**

Proteins <20 kD use a 0.22 m membrane

IX. REFERENCES

1. Thorpe, G.H.G., Kricka, L.J., Mosely, S.B. and Whitehead, T.P. Phenols as enhancers of the chemiluminescent horseradish peroxidase-luminol-hydrogen peroxide reaction: Application in luminescence-monitored enzyme immunoassays. *Clin. Chem.* 31:1335-1341 (1985).
2. Kaufmann, S.H., Ewing, C.M. and Shaper, J.H. The erasable Western blot. *Analyt. Biochem.* 161:89-95 (1987).
3. Towbin, H., Staehelin, T. and Gordon, J. Electrophoretic transfer of proteins from polyacrylamide gels to nitrocellulose sheets: Procedure and some applications. *PNAS* 76:4340-4354 (1979).

X. ORDERING INFORMATION

For additional information, please refer to www.perkinelmer.com/proteinbiology.

Western Lightning–ECL Enhanced Chemiluminescent Substrate

Western Lightning Plus –ECL	2 bottles (65 mL each)	NEL103001EA
	2 bottles (15 mL each)	NEL103E001EA
	2 bottles (170 mL each)	NEL104001EA
	4 bottles (170 mL each)	NEL105001EA
Western Lightning –ECL	2 bottles (65 mL each)	NEL100001EA
	2 bottles (170 mL each)	NEL101001EA
	4 bottles (170 mL each)	NEL102001EA

PolyScreen® PVDF Membranes

PolyScreen PVDF Hybridization Transfer Membrane	1 (26.5 cm x 3.75 m) roll	NEF1002001PK
	10 (20 x 20 cm) sheets	NEF1000001PK
	50 (7 x 8.4 cm) sheets	NEF1003001PK
PolyScreen PVDF Hybridization Transfer Membrane for “Mini Gels”		

Nitrocellulose Membranes

Protran® Nitrocellulose (0.2 µm pore size)	1 (30 cm x 3 m) roll	NBA083C001EA
	5 (15 x 15 cm) sheets	NBA083D001EA
	5 (20 x 20 cm) sheets	NBA083E001EA
	5 (25 x 25 cm) sheets	NBA083F001EA
	5 (33 x 56 cm) sheets	NBA083G001EA
Protran® Nitrocellulose (0.45 µm pore size)	1 (15 cm x 3 m) roll	NBA085A001EA
	1 (20 cm x 3 m) roll	NBA085B001EA
	1 (30 cm x 3 m) roll	NBA085C001EA
	5 (15 x 15 cm) sheets	NBA085D001EA
	5 (20 x 20 cm) sheets	NBA085E001EA
	5 (25 x 25 cm) sheets	NBA085F001EA
	5 (33 x 56 cm) sheets	NBA085G001EA

Kodak Autoradiography Film

BioMax® Light-1 Autoradiography Film	13 x 18 cm (5 x 7 in.)	50 sheets, non-interleaved packaging	8689358001EA
	18 x 24 cm (7 x 9.5 in.)		8194540001EA
	20.3 x 25.4 cm (8 x 10 in.)		1788207001EA
	13 x 18 cm (5 x 7 in.)	50-sheet ReadyPack; each sheet	1917012001EA

X-OMAT Blue (XB) Film	20.3 x 25.4 cm (8 x 10 in.)	individually wrapped	8761520001EA
	13 x 18 cm (5 x 7 in.)	100 sheets, non-inter- leaved packaging	NEF586001EA
	18 x 24 cm (7 x 9.5 in.)		NEF585001EA
	20.3 x 25.4 cm (8 x 10 in.)		NEF596001EA
	35 x 43 cm (14 x 17 in.)		NEF595001EA

Enzyme Conjugated Secondary Antibodies

Anti-human IgG (goat)* -AP Conjugate	1 mg	1 mg/mL	NEF801001EA
Anti-human IgG (goat)* -HRP Conjugate	1 mg	1 mg/mL	NEF802001EA
Anti-human IgG (goat) -biotin Conjugate	0.5 mg	Lyophilized	NEF803001EA
Anti-mouse IgG (goat) -AP Conjugate	1 mg	1 mg/mL	NEF821001EA
Anti-mouse IgG (goat) -HRP Conjugate	1 mg	1 mg/mL	NEF822001EA
Anti-mouse IgG (goat) -biotin Conjugate	0.5 mg	Lyophilized	NEF823001EA
Anti-rabbit IgG (goat) -AP Conjugate	1 mg	1 mg/mL	NEF811001EA
Anti-rabbit IgG (goat) -HRP Conjugate	1 mg	1 mg/mL	NEF812001EA
Anti-rabbit IgG (goat) -biotin Conjugate	0.5 mg	Lyophilized	NEF813001EA

* *Bovine serum albumin added as a stabilizer.*

Antifluorescein-AP Conjugate	2 x 250 µl	NEF709001PK
Antifluorescein-HRP Conjugate	2 x 250 µl	NEF710001EA
Streptavidin-HRP Conjugate	2 x 250 µl	NEL750001EA
Streptavidin-AP Conjugate	2 x 250 µl	NEL751001EA

Molecular Weight Markers

Multicolored Protein Markers	8 to 220 kDa	500 µl, ≥ 50 lanes	NEL316001EA
Biotinylated Protein Molecular Weight Markers	12 to 97 kDa	50 µl (20x), ≥ 100 lanes	NEL310001EA

Phosphorylation Analysis

Phos-Tag® Enrich	6 samples, 1-2 mg	PRT401001KT
Phosphoprotein Enrichment Kit	total protein	
Phos-tag® 300/460 Phosphoprotein Blot Stain	16 mini-gel blots	PRD410A001KT
Phos-tag® 540 Phosphoprotein Blot Stain	16 mini-gel blots	PRD510A001KT

XI. APPENDIX A

SIMPLIFIED WESTERN BLOTTING PROTOCOL

1. It is recommended that the transfer buffer [Towbin transfer buffer, pH 8.3 (3)] be made up ahead of time and pre-cooled to 4°C. In this way, it will have a chance to degas before use. Bubbles in the transfer buffer will increase the chance of trapping air between the membrane and the gel. Air bubbles create points of high resistance, resulting in "bald spots" (i.e., areas of low-efficiency transfer and band distortion).
2. Cut the membrane slightly larger than the gel. If using a Poly-Screen® membrane, pre-wet with methanol or ethanol, then rinse with water. For nitrocellulose, just rinse with water. Be sure to wear gloves at all times when handling the membranes. Mark one side of the membrane for future reference.
3. Equilibrate both the membrane and the gel in transfer buffer for 15 - 20 minutes.
4. Wet two Scotch-Brite® pads and two pieces of filter paper (Whatman® 3MM cut to the size of the gel) in transfer buffer.
5. Prepare the "sandwich" as follows:
 - Put one piece of wet filter paper on a Scotch-Brite® pad.
 - Place the equilibrated gel on top of the filter paper.
 - Place the membrane on top of the gel.
 - Place the second piece of wet filter paper over the membrane.
 - Be sure to remove any air bubbles trapped between the gel, membrane, and filter paper layers. This is easily done by rolling a clean pipet over the sandwich.
 - Complete the sandwich with the second Scotch-Brite® pad.
6. Insert the sandwich into the transfer apparatus with the membrane positioned between the gel and the appropriate electrode. Most polypeptides are eluted from SDS-polyacrylamide gels as anions and therefore the membrane should usually be placed between the gel and the anode. If there is any question about which side to transfer then place a membrane on both sides of the gel.
7. Fill the transfer apparatus with buffer. Pour the transfer buffer

slowly to prevent bubble formation. Cool to 4°C and transfer at a constant current or voltage.

8. When the transfer is complete, remove the membranes and allow them to air dry at room temperature. Since dehydrated proteins bind more strongly to the membrane, this helps to prevent loss of target during subsequent washes.

XII. APPENDIX B

SIMPLIFIED CHEMILUMINESCENCE PROTOCOL

This protocol has been used successfully in our laboratories. It may be adapted as necessary to suit individual needs.

Note: All incubations require gentle agitation on a rocker or shaking. All steps are performed at room temperature.

1. Membrane Preparation

- a. Separate proteins by electrophoresis and transfer to PolyScreen® or nitrocellulose membrane. See Appendix A.
- b. Block non-specific binding sites by incubating the membrane in 5% non-fat dry milk in PBS-T for at least one hour with gentle agitation.
- c. Wash the membrane three times for 5 minutes with PBS-T.
- d. Dilute the primary antibody in 1% BSA/PBS-T and incubate with the membrane for at least one hour with gentle agitation.
- e. Wash the membrane with PBS-T once for 15 minutes, and then four times for 5 minutes each.
- f. Dilute the HRP-labeled second antibody in 1% BSA/PBS-T and incubate with the membrane for at least one hour with gentle agitation.
- g. Wash the membrane with PBS-T once for 15 minutes and then four times for 5 minutes each.

2. Chemiluminescence Reagent Protocol

- a. Prepare the chemiluminescence reagent (0.125 ml of Chemiluminescence Reagent per cm² of membrane) by mixing equal volumes of the Enhanced Luminol Reagent and the Oxidizing Reagent.
- b. Incubate the membrane in the chemiluminescence reagent for one minute with gentle agitation.

3. Protein Visualization

- a. Remove excess chemiluminescence reagent by draining or blotting and place the membrane in a plastic sheet protector.
- b. **Film:** Expose to BioMax Light or X-OMAT Blue Autoradiography Film for 30 seconds. Develop the film and, if necessary, use the result to determine an optimum exposure.

PerkinElmer Geliance 600 or 1000 CCD Imager: The optimum settings for chemiluminescence imaging are as follows:

- o Iris – 1.2
- o No Binning
- o No Light
- o No Filter

Select series capture.

This example will take

5 images, each with a 1 minute exposure

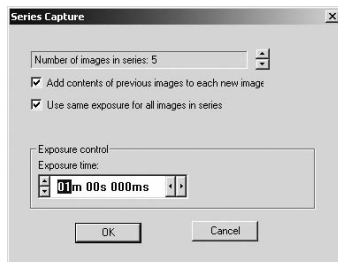
time and will add the data from each previ-

ous image to the next image. This will give 5 images with exposure times

of 1min, 2min, 3min, 4min, and 5min respectively but will take a total of 5

minutes to complete. Adjust the time interval between each capture accord-

ing to expected intensity.



XIII. APPENDIX C

REPROBING WESTERN BLOTS ON POLYSCREEN® AND NITROCELLULOSE MEMBRANES

Western Lightning –ECL allows researchers to effectively reprobe their Western Blots. Stripping of antibodies from membranes has been described for ¹²⁵I labeled proteins¹ and the extension of this technique to chemiluminescence substrates has been found to be feasible. Stripping the antibodies from the membrane allows one to reuse Western Blots thereby saving significant time and money.

The protocol to do the reprobing is as follows:

1. The Western blot is carried out as usual and after the film or CCD exposures are complete the membrane is subjected to the stripping procedure. Best results are obtained if the membrane is not allowed to dry.
2. After the film or CCD exposure wash the membrane for 4 X 5 minutes in PBST.
3. Incubate the membrane for 30 minutes at 50°C in the stripping buffer:
62.5 mM Tris-HCl pH 6.8
2% SDS
100 mM 2-mercaptoethanol
4. Wash the membrane for 6 X 5 minutes in PBST.
5. Incubate the membrane for 1 minute in Western Lightning –ECL (standard or Plus version). Expose to film for 1 minute to 1 hour to make sure that the original signal is removed.
6. Wash the membrane again for 4 X 5 minutes in PBST.
7. The membrane is now ready for reuse. Start at the blocking step (1b) in Appendix B of this manual.

This protocol has been used on PolyScreen® and nitrocellulose membranes. Four successful reprobing have been carried out on both types of membranes.

XIV. APPENDIX D

POLYSCREEN® MEMBRANE WETTING PROTOCOL

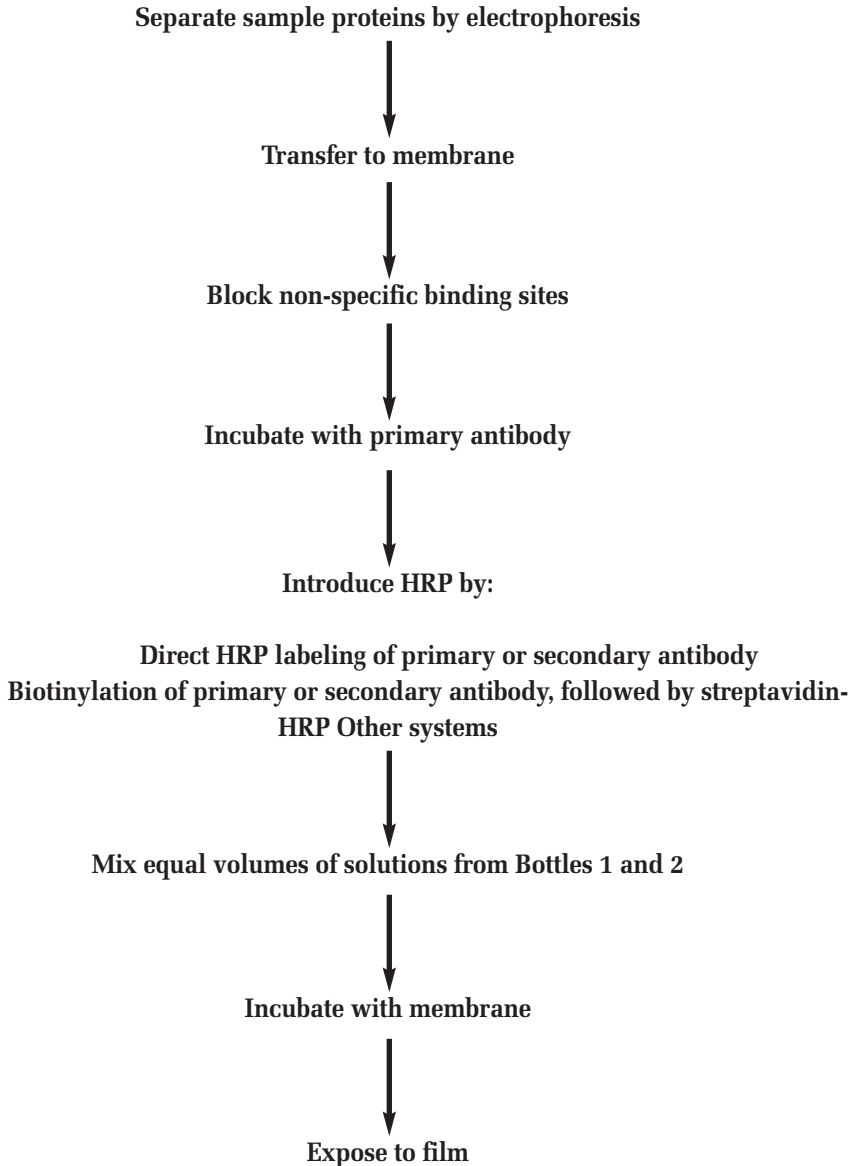
PolyScreen® is extremely hydrophobic and will not wet in an aqueous solution unless membrane is pre-wet with alcohol.

1. Wet the membrane in methanol or ethanol for at least one minute. Soak the membrane until it changes from an opaque white to a uniform translucent gray.
2. Rinse the membrane in distilled water to wash off the alcohol for 2-3 minutes. If the membrane floats, gently push it into the water with plastic forceps until it wets.
3. Equilibrate the membrane in transfer buffer. Soak the membrane in the buffer for 10-15 minutes to displace the water and any bubbles which may form.

NOTE: If the membrane dries (even partially) at any time during the experiment, you must wet it with alcohol and rinse with distilled water before proceeding.

XV. APPENDIX E

FLOW CHART FOR WESTERN LIGHTNING –ECL AND LIGHTNING PLUS –ECL DETECTION



XVI. APPENDIX F

TITRATION OF ANTIBODIES

The high sensitivity achieved with chemiluminescence detection sometimes requires the researcher to use less primary and/or secondary antibodies than that required for chromogenic detection. The excess use of antibodies in chemiluminescence detection can lead to short exposure times (seconds) and/or high background.

To achieve the maximum signal to noise ratio the primary and secondary antibodies should be optimized in a titration experiment. The following table gives an example of a typical titration experiment. The starting primary antibody dilution is 1:1000 and the starting secondary antibody dilution is 1:1000. The membrane samples are shown as #1 through #9.

	Primary Antibody Conc.		
Secondary Anti-body Conc.	1:1000	1:2000	1:4000
1:1000	#1	#2	#3
1:2000	#4	#5	#6
1:4000	#7	#8	#9

The above titration allows the determination of the optimum concentration of the primary and secondary antibodies for chemiluminescence detection.

XVII. APPENDIX G

TOTAL PROTEIN STAINING

The detection of proteins transferred to PolyScreen® and nitrocellulose membranes by the total protein stains Ponceau S and Coomassie Brilliant Blue is compatible with subsequent chemiluminescence detection using

Western Lightning –ECL or Western Lightning Plus –ECL . Ponceau S stain has the advantage of requiring no destaining procedure as the stain is removed during the subsequent blocking procedure. The Coomassie Brilliant Blue stain is not removed from the membrane during the detection procedure but the color doesn't interfere with the chemiluminescence signal.

The following protocols have been used successfully in our laboratories:

Ponceau S

Prepare a 2% (2 mg/ml) stock solution of Ponceau S dye in 30% (wt/v) trichloroacetic acid. Dilute the stock ten-fold in 1% acetic acid (final concentration of Ponceau S is 0.2%).

Incubate the membrane in Ponceau S stain for 2 minutes. Rinse off the residual stain with distilled water and record the results. Proceed to the chemiluminescence detection procedure.

Ponceau S

Prepare a 2% (2 mg/ml) stock solution of Ponceau S dye in 30% (wt/v) trichloroacetic acid. Dilute the stock ten-fold in 1% acetic acid (final concentration of Ponceau S is 0.2%).

Incubate the membrane in Ponceau S stain for 2 minutes. Rinse off the residual stain with distilled water and record the results. Proceed to the chemiluminescence detection procedure.

Coomassie Brilliant Blue

Prepare a 0.1% (1 mg/ml) working solution of Coomassie Brilliant Blue in 50% methanol and 10% acetic acid solution.

Incubate the membrane in Coomassie Brilliant Blue stain for 2 minutes. Pour off the excess stain and if desired destain the membrane in 50% methanol/10% acetic acid for 10 minutes. Rinse the membrane in 1X PBS and proceed to the chemiluminescence detection procedure.

XVIII. TRADEMARKS

PerkinElmer® is a trademark of PerkinElmer, Inc.
Scotch-Brite® is a trademark of the 3M Company.
Whatman® is a trademark of Whatman Paper Ltd.
Tween® is a trademark of I.C.I. Ltd.
Carnation™ is a trademark of the Carnation Co.
Phos-tag® is a trademark of NARD Institute..

XIX. SUPPORT INFORMATION

For further technical information or to place an order, call:

World Headquarters:
PerkinElmer, Inc.
940 Winter Street
Waltham, MA 02451 USA
1-800-762-4000

European Headquarters:
PerkinElmer, Inc.
Imperiastraat 8
B-1930 Zaventem
Belgium
+32 2 717 7911

For customers outside of the U.S. and Europe:
Please contact your local distributor.
Website: www.perkinelmer.com

Technical Support:
In Europe: techsupport.europe@perkinelmer.com
In U.S. and Rest of the World:
techsupport@perkinelmer.com

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Italy/Netherlands/Sweden/Switzerland - EPO116454
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Canada - 1217121
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Worldwide Headquarters:
PerkinElmer Life and Analytical Sciences
710 Bridgeport Avenue Shelton, CT 06484-4794 USA
Tel: (800) 762-400 or (+1)203-9254602
www.perkinelmer.com