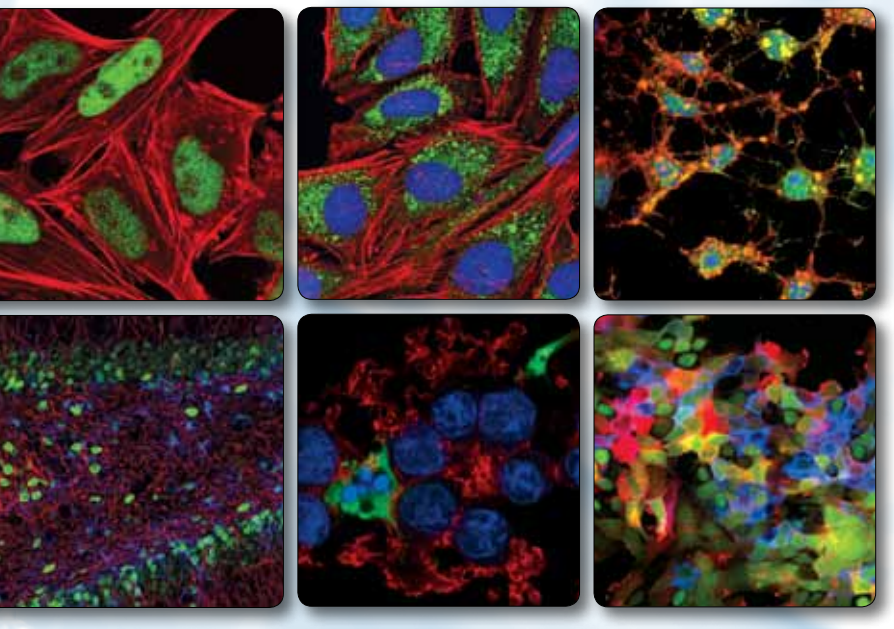
UNPARALLELED PRODUCT QUALITY, VALIDATION, AND TECHNICAL SUPPORT



Antibodies and Kits for the Study of Apoptosis and Autophagy

Cell Signaling TECHNOLOGY®

XP™ Monoclonal Antibodies
for Apoptosis and Autophagy

XP™ Monoclonal Antibodies are a line of high quality rabbit monoclonal antibodies exclusively available from Cell Signaling Technology (CST). Any product labeled with XP has been carefully selected based on superior performance in all approved applications.

XP Monoclonal Antibodies are generated using XMT® technology, a proprietary monoclonal method developed at CST. This technology provides access to a broad range of antibody-producing B cells unattainable with traditional monoclonal technologies, allowing more comprehensive screening and the identification of XP monoclonal antibodies with:

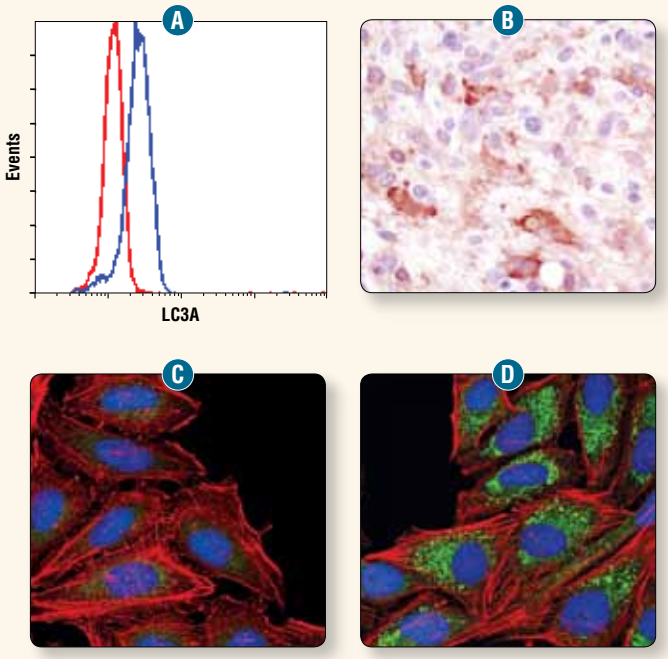
eXceptional specificity
As with all CST™ antibodies, the antibody is specific to your target of interest, saving you valuable time and resources.

+eXceptional sensitivity
The antibody will provide a stronger signal for your target protein in cells and tissues, allowing you to monitor expression of low levels of endogenous proteins, saving you valuable materials.

+eXceptional stability and reproducibility
XMT technology combined with our stringent quality control ensures maximum lot-to-lot consistency and the most reproducible results.

=eXceptional Performance™
XMT technology coupled with our extensive antibody validation and stringent quality control delivers XP monoclonal antibodies with eXceptional Performance in the widest range of applications.

LC3A (D50G8) XP™ Rabbit mAb #4599 is an example of an antibody with superior performance in a wide range of tested applications.



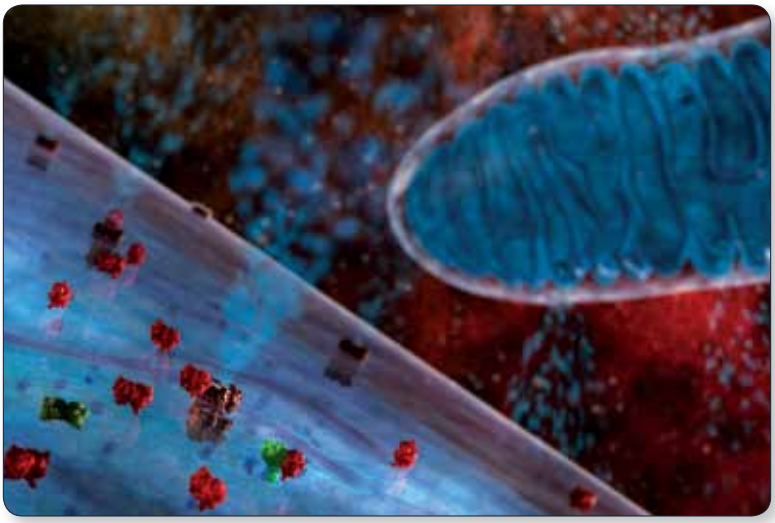
LC3A (D50G8) XP™ Rabbit mAb #4599: Flow cytometric analysis of chloroquine-treated HeLa cells **(A)** using #4599 (blue) compared to Rabbit (DA1E) mAb IgG XP™ Isotype Control #3900 (red). IHC analysis of paraffin-embedded human glioblastoma multiforme **(B)** using #4599. Confocal IF analysis of HeLa cells, untreated **(C)** or chloroquine-treated **(D)**, using #4599 (green). Actin filaments were labeled with DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).

Visit our website for more experimental details, additional information, and a complete list of available XP monoclonal antibodies.

Antibodies and Kits for the Study of

Apoptosis and Autophagy

Cell Signaling Technology provides the highest possible quality activation state and total protein antibodies available for the study of signaling pathways central to cell survival and programmed cell death. CST™ antibodies have been extensively validated by in-house scientists in applications including western blotting, immunofluorescence, flow cytometry, immunohistochemistry, ELISA, and chromatin immunoprecipitation. Comprehensive and up-to-date information can be found at our website.



The Bcl-2 family of proteins is composed of pro- and anti-apoptotic members that homo and heterodimerize with one another. Together, these serve as a rheostat mechanism to regulate the onset of apoptosis at the mitochondrion. In this image, the balance is in favor of the pro-apoptotic Bad proteins (red) that outnumber the anti-apoptotic Bcl-xL proteins (green). As a result, the mitochondrial pore composed of VDAC in the inner membrane and ANT in the outer membrane (both in brown) is shown releasing small molecules into the cytosol during the permeability transition. Cytochrome c (blue) below the outer mitochondrial membrane is poised to spill into the cytosol and trigger apoptosis once the outer mitochondrial membrane ruptures.

Table of Contents

Environmental commitment: **eco.cellsignal.com**

Antibody Sampler Kits

Our Antibody Sampler Kits contain sample sizes of several antibodies directed against a protein, pathway, or cellular process of interest. Each kit contains enough primary and secondary antibodies to perform four western blots per target.

#9915 Apoptosis Antibody Sampler Kit
Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb #9664, Caspase-3 Ab #9662, Cleaved Caspase-7 (Asp198) Ab #9491, Caspase-7 Ab #9492, Cleaved Caspase-9 (Asp330) Ab (Human Specific) #9501, Caspase-9 Ab (Human Specific) #9502, Cleaved PARP (Asp214) Ab (Human Specific) #9541, PARP Ab #9542, Anti-rabbit IgG, HRP-linked Ab #7074

#9930 Apoptosis Antibody Sampler Kit (Mouse Specific)
Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb #9664, Caspase-3 Ab #9662, Cleaved Caspase-6 (Asp162) Ab #9761, Caspase-6 Ab #9762, Cleaved Caspase-9 (Asp353) Ab (Mouse Specific) #9509, Caspase-9 Ab (Mouse Specific) #9504, Caspase-12 Ab #2202, Cleaved PARP (Asp214) Ab (Mouse Specific) #9544, Anti-rabbit IgG, HRP-linked Ab #7074

#9942 Pro-Apoptosis Bcl-2 Family Antibody Sampler Kit
Phospho-Bad (Ser112) (40A9) Rabbit mAb #5284, Bad (D24A9) Rabbit mAb #9239, Bax (D2E11) Rabbit mAb #5023, BID Ab (Human Specific) #2002, Bik Ab #4592, Bim (C34C5) Rabbit mAb #2933, Bok Ab #4521, Puma Ab #4976, Anti-rabbit IgG, HRP-linked Ab #7074

#4445 Autophagy Antibody Sampler Kit
Atg3 Ab #3415, Atg5 Ab #2630, Atg7 Ab #2631, Atg12 (D88H11) Rabbit mAb #4180, Beclin-1 (D40C5) Rabbit mAb #3495, LC3A (D50G8) XP™ Rabbit mAb #4599, LC3B (D11) XP™ Rabbit mAb #3868, Anti-rabbit IgG, HRP-linked Ab #7074

#9105 Phospho-Bad Antibody Sampler Kit
Phospho-Bad (Ser112) (7E11) Mouse mAb #9296, Phospho-Bad (Ser136) (185D10) Rabbit mAb #5286, Phospho-Bad (Ser155) Ab #9297, Bad (D24A9) Rabbit mAb #9239, Anti-rabbit IgG, HRP-linked Ab #7074, Anti-mouse IgG, HRP-linked Ab #7076, pCMV-Tag4A-mBad/GrpE #2888

#9929 Cleaved Caspase Antibody Sampler Kit
Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb #9664, Cleaved Caspase-6 (Asp162) Ab #9761, Cleaved Caspase-7 (Asp198) Ab #9491, Cleaved Caspase-9 (Asp315) Ab (Human Specific) #9505, Cleaved Caspase-9 (Asp330) Ab (Human Specific) #9501, Cleaved PARP (Asp214) Ab (Human Specific) #9541, Anti-rabbit IgG, HRP-linked Ab #7074

NEW **#9770 IAP Family Antibody Sampler Kit**
c-IAP1 Ab #4952, c-IAP2 (58C7) Rabbit mAb #3130, Livin (D61D1) XP™ Rabbit mAb #5471, Survivin (71G4B7) Rabbit mAb #2808, XIAP (3B6) Rabbit mAb #2045, Anti-rabbit IgG, HRP-linked Ab #7074

#9936 NF-κB Pathway Antibody Sampler Kit
Phospho-IκBα (Ser32) (14D4) Rabbit mAb #2859, IκBα (L35A5) Mouse mAb (Amino-terminal Antigen) #4814, Phospho-IKKα/β (Ser176/180) (16A6) Rabbit mAb #2697, IKKα Ab #2682, IKKβ (L570) Ab (IP Preferred) #2678, Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb #3033, NF-κB p65 (C22B4) Rabbit mAb #4764, Anti-rabbit IgG, HRP-linked Ab #7074, Anti-mouse IgG, HRP-linked Ab #7076

#4766 NF-κB Family Member Antibody Sampler Kit
NF-κB p65 (C22B4) Rabbit mAb #4764, NF-κB p65 Ab #3034, NF-κB2 p100/p52 (18D10) Rabbit mAb (Human Specific) #3017, NF-κB2 p100/p52 Ab #4882, NF-κB1 p105 Ab #4717, NF-κB1 p105/p50 Ab #3035, c-Rel Ab #4727, RelB (C1E4) Rabbit mAb #4922, Anti-rabbit IgG, HRP-linked Ab #7074

#4888 NF-κB Non-Canonical Pathway Antibody Sampler Kit
Phospho-IKKα/β (Ser176/180) (16A6) Rabbit mAb #2697, IKKα Ab #2682, Phospho-NF-κB2 p100 (Ser866/870) Ab #4810, NF-κB2 p100/p52 Ab #4882, NIK Ab #4994, RelB (C1E4) Rabbit mAb #4922, TRAF2 Ab #4712, TRAF3 Ab #4729, Anti-rabbit IgG, HRP-linked Ab #7074

#4767 NF-κB p65 Antibody Sampler Kit
Phospho-NF-κB p65 (Ser276) Ab #3037, Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb #3033, NF-κB p65 Ab #3034, Acetyl-NF-κB p65 (Lys310) Ab #3045, NF-κB p65 (C22B4) Rabbit mAb #4764, Anti-rabbit IgG, HRP-linked Ab #7074

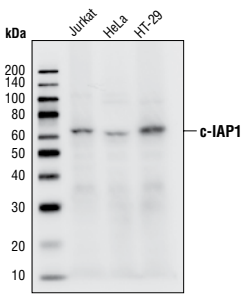
#9919 Phospho-p53 Antibody Sampler Kit
Phospho-p53 (Ser6) Ab #9285, Phospho-p53 (Ser9) Ab #9288, Phospho-p53 (Ser15) Ab #9284, Phospho-p53 (Ser15) (16G8) Mouse mAb #9286, Phospho-p53 (Ser20) Ab #9287, Phospho-p53 (Ser37) Ab #9289, Phospho-p53 (Ser46) Ab #2521, Phospho-p53 (Ser392) Ab #9281, p53 (7F5) Rabbit mAb #2527, Anti-rabbit IgG, HRP-linked Ab #7074

NEW **#9779 Pim Kinase Antibody Sampler Kit**
Phospho-Bad (Ser112) (40A9) Rabbit mAb #5284, Bad (D24A9) Rabbit mAb #9239, Pim-1 (C93F2) Rabbit mAb #3247, Pim-2 (D1D2) XP™ Rabbit mAb #4730, Pim-3 (D17C9) Rabbit mAb #4165, Anti-rabbit IgG, HRP-linked Ab #7074

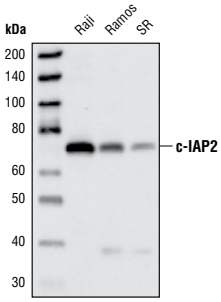
#9941 Pro-Survival Bcl-2 Family Antibody Sampler Kit
Phospho-Bcl-2 (Thr56) Ab (Human Specific) #2875, Phospho-Bcl-2 (Ser70) (5H2) Rabbit mAb #2827, Bcl-2 (50E3) Rabbit mAb #2870, Bcl-xL (54H6) Rabbit mAb #2764, Mcl-1 (D35A5) Rabbit mAb #5453, Anti-rabbit IgG, HRP-linked Ab #7074

IAP Family Antibody Sampler Kit #9770:

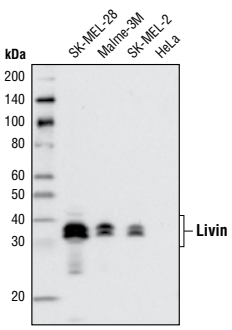
This kit offers an economical means to investigate apoptosis inhibitor proteins.



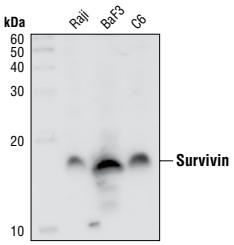
c-IAP1 Antibody #4952: WB analysis of extracts from Jurkat, HeLa, and HT-29 cells using #4952.



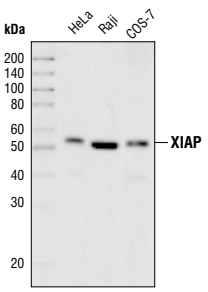
c-IAP2 (58C7) Rabbit mAb #3130: WB analysis of extracts from Raji, Ramos, and SR cell lines using #3130.



Livin (D61D1) XP™ Rabbit mAb #5471: WB analysis of extracts from various cell lines using #5471.



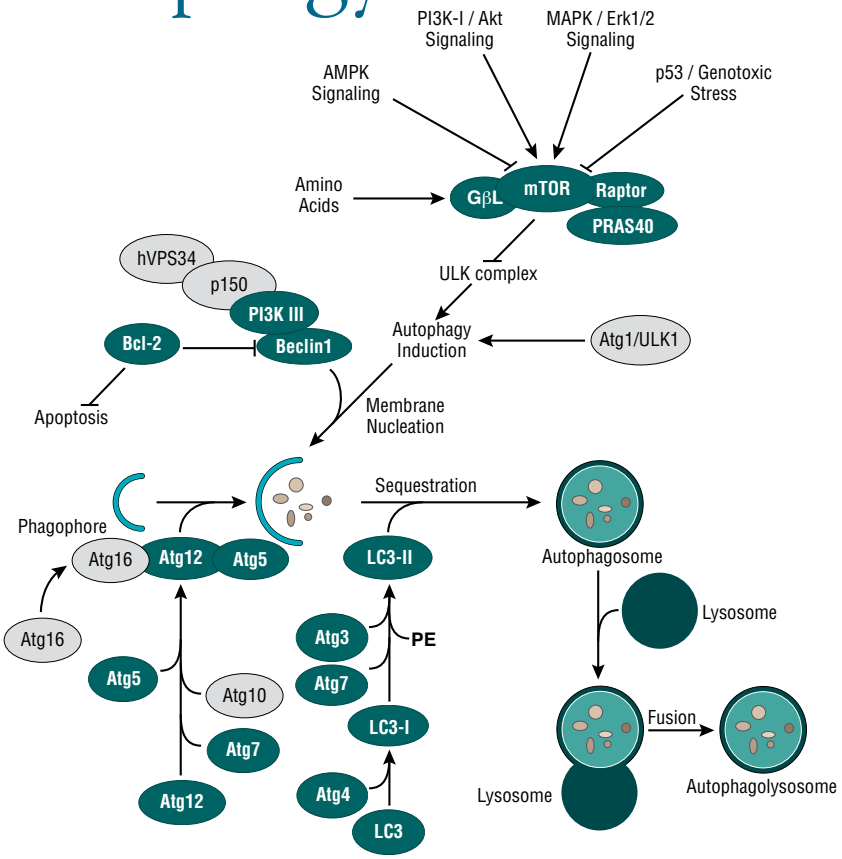
Survivin (71G4B7) Rabbit mAb #2808: WB analysis of extracts from Raji, BaF3, and C6 cell lines using #2808.



XIAP (3B6) Rabbit mAb #2045: WB analysis of extracts from HeLa, Raji, and COS-7 cell lines using #2045.

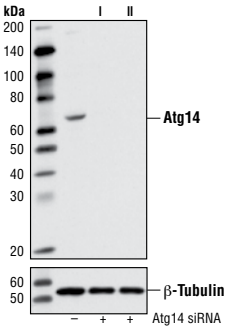
APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

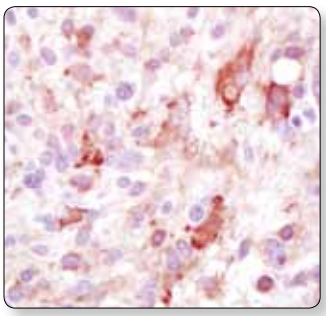
Autophagy



			Applications	Reactivity
	#4445	Autophagy Antibody Sampler Kit		
	#3415	Atg3 Antibody	W	H, M, R, (Mk, C, X, B, Dg, Sc)
NEW	#5299	Atg4B Antibody	W	H, M, R
NEW	#5262	Atg4C Antibody	W, IP	H, M, Mk
	#2630	Atg5 Antibody	W, IP	H, (Mk)
	#2631	Atg7 Antibody	W	H, M, R, (Mk)
	#4180	Atg12 (D88H11) Rabbit mAb	W, IP	H, M, R, Mk
	#2010	Atg12 Antibody (Human Specific)	W, IP, IF-IC	H
	#2011	Atg12 Antibody (Mouse Specific)	W, IP, IF-IC	M
NEW	#5504	Atg14 Antibody	W, IP	H, M, R, (Mk)
	#3495	Beclin-1 (D40C5) Rabbit mAb	W, IP	H, M, R, Mk
	#3738	Beclin-1 Antibody	W, IP	H, M, R
NEW	#4599	LC3A (D50G8) XP™ Rabbit mAb	W, IP, IHC-P, IF-IC, F	H, M, R, (Mk, Dg)
	#4108	LC3A/B Antibody	W, IF-IC, F	H, M, R, (Mk, C, X, Dg, Z)
	#3868	LC3B (D11) XP™ Rabbit mAb	W, IP, IHC-P, IF-IC, F	H, M, R, (Mk, B, Pg)
	#2775	LC3B Antibody	W, IF-IC, F	H, M, R, (Mk, B, Pg)
NEW	#5202	NBR1 Antibody	W, IP	H, M, R
NEW	#3358	PI3 Kinase Class III (D4E2) Rabbit mAb	W	H, M, R, Mk
	#3811	PI3 Kinase Class III Antibody	W, IP	H, M, R
NEW	#5114	SQSTM1/p62 Antibody	W	H, M, R, (Mk)
NEW	#4634	Phospho-ULK1 (Ser467) Antibody	W	M, (H, R, Mk)
NEW	#5869	Phospho-ULK1 (Ser555) (D1H4) Rabbit mAb	W, IP	H, M, (R)
	#4776	ULK1 (A705) Antibody	W	H
	#4773	ULK1 (R600) Antibody	W	H, Mk
NEW	#5320	UVRAG Antibody	W, IP	H, M

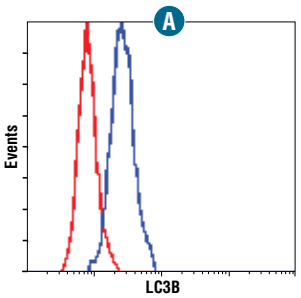
Atg14 Antibody #5504: WB analysis of extracts from HeLa cells, transfected with 100 nM SignalSilence® Control siRNA (Unconjugated) #6568 (-), SignalSilence® Atg14 siRNA I #6286 (+) or SignalSilence® Atg14 siRNA II #6287 (+), using #5504 (upper) or β-Tubulin (9F3) Rabbit mAb #2128 (lower). The Atg14 Antibody confirms silencing of Atg14 expression, while the β-Tubulin (9F3) Rabbit mAb is used as a loading control.

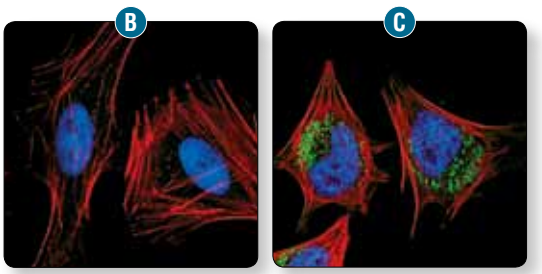




LC3A (D50G8) XP™ Rabbit mAb #4599: IHC analysis of paraffin-embedded human glioblastoma multiforme using #4599.

LC3B (D11) XP™ Rabbit mAb #3868: Flow cytometric analysis of HeLa cells **(A)** using #3868 (blue) compared to a nonspecific negative control antibody (red). Confocal IF analysis of HeLa cells, untreated **(B)** or chloroquine-treated **(C)**, using #3868 (green). Actin filaments were labeled using DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).





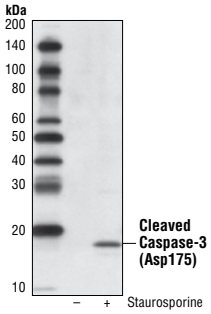
Selected Application References:

Beclin-1 Antibody #3738:
Shi, C.S. and Kehrl, J.H.(2008) *J. Biol. Chem.* 283, 33175–33182. (W)

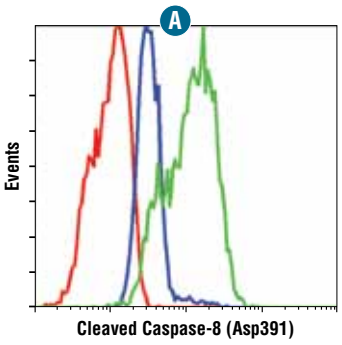
LC3B Antibody #2775:
Li, C. et al. (2009) *Mol. Cell. Biol.* 1, 37–45. (W)
Chen, Y.F. et al. (2009) *Genes Dev.* 23, 1183–11894. (W)
Deuretzbacher, A. et al. (2009) *J. Immunol.* 183, 5847–5860. (W, IF-IC)

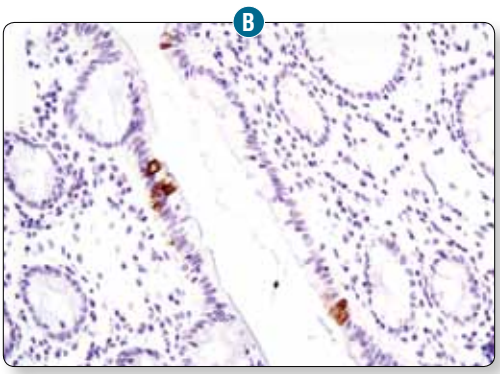
Caspase Signaling

Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb (Biotinylated) #9654: WB analysis of extracts from HeLa cells, untreated or treated with Staurosporine #9953 (1 µM, 3 hrs), using #9654 and detected with Streptavidin-HRP #3999.



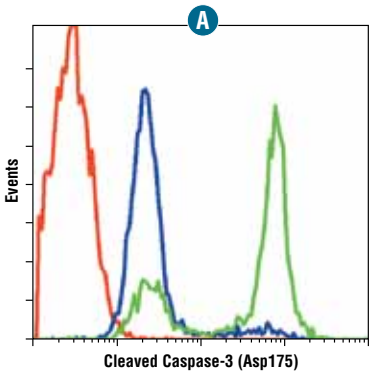
Cleaved Caspase-8 (Asp391) (18C8) Rabbit mAb #9496: Flow cytometric analysis of Jurkat cells, untreated (blue) or etoposide-treated (green) **(A)**, using #9496 compared to a nonspecific negative control antibody (red). IHC analysis of paraffin-embedded human colon (chronic inflammation) **(B)** using #9496.

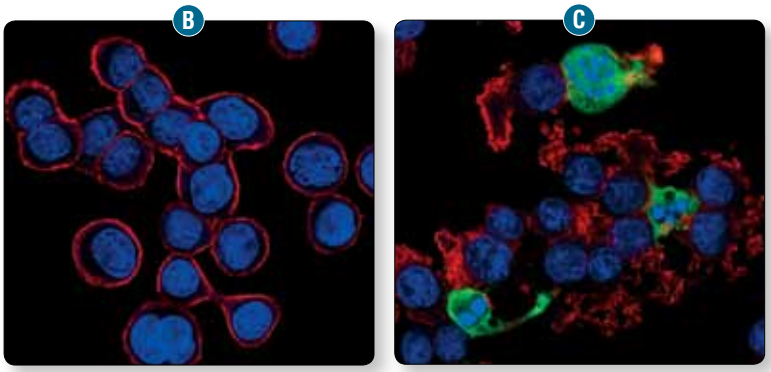




			Applications	Reactivity
	#4199	Cleaved Caspase-1 (Asp297) (D57A2) Rabbit mAb	W, IP	H, (Mk)
	#3866	Caspase-1 (D7F10) Rabbit mAb	W, IP	H, (Mk)
	#2225	Caspase-1 Antibody	W, IP, IHC-P	H
	#2224	Caspase-2 (C2) Mouse mAb	W	H
	#9660	Apoptosis Marker: Cleaved Caspase-3 (Asp175) Western Detection Kit	W	
	#9664	Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb	W, IP, IHC-P, IHC-F, IF-IC, F	H, M, R, Mk, (Dg)
NEW	#9654	Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb (Biotinylated)	W	H, M, R, Mk
	#9661	Cleaved Caspase-3 (Asp175) Antibody	W, IHC-P, IHC-F, IF-IC, F	H, M, R, Mk, B, (Pg, Dg)
	#9669	Cleaved Caspase-3 (Asp175) Antibody (Alexa Fluor® 488 Conjugate)	IF-IC, F	H, M, R, Mk, B, (Pg)
	#9665	Caspase-3 (8G10) Rabbit mAb	W, IP	H, M, R, Mk
	#9662	Caspase-3 Antibody	W, IP, IHC-P	H, M, R, Mk
	#9668	Caspase-3 (3G2) Mouse mAb	W	H
NEW	#4450	Caspase-4 Antibody	W	H, (Mk)
NEW	#4429	Caspase-5 Antibody	W	H
	#9761	Cleaved Caspase-6 (Asp162) Antibody	W	H, M, R
	#9762	Caspase-6 Antibody	W	H, M, R
	#9491	Cleaved Caspase-7 (Asp198) Antibody	W, IP	H, M, R, Mk
	#9492	Caspase-7 Antibody	W	H, M, R, Mk
	#9494	Caspase-7 (C7) Mouse mAb (Human Specific)	W	H
	#9748	Cleaved Caspase-8 (Asp384) (11G10) Mouse mAb	W	H
	#9429	Cleaved Caspase-8 (Asp387) Antibody (Mouse Specific)	W	M, (R)
	#9496	Cleaved Caspase-8 (Asp391) (18C8) Rabbit mAb	W, IHC-P, IF-IC, F	H
NEW	#4790	Caspase-8 (D35G2) Rabbit mAb	W	H, M, R, (Mk, Pg)
	#4927	Caspase-8 Antibody (Mouse specific)	W	M
	#9746	Caspase-8 (1C12) Mouse mAb	W, IP	H
	#9505	Cleaved Caspase-9 (Asp315) Antibody (Human Specific)	W, IP	H
	#9501	Cleaved Caspase-9 (Asp330) Antibody (Human Specific)	W, IP	H, Mk
	#9509	Cleaved Caspase-9 (Asp353) Antibody (Mouse Specific)	W, IF-IC	M
	#9507	Cleaved Caspase-9 (Asp353) Antibody (Rat Specific)	W, IF-IC	R
	#9502	Caspase-9 Antibody (Human Specific)	W, F	H
	#9504	Caspase-9 Antibody (Mouse Specific)	W	M
	#9506	Caspase-9 Antibody (Rat Specific)	W	R
	#9508	Caspase-9 (C9) Mouse mAb	W	H, M, R, Hm, Mk
	#9752	Caspase-10 Antibody	W	H, M, R
	#2202	Caspase-12 Antibody	W	M

Cleaved Caspase-3 (Asp175) Antibody #9661: Flow cytometric analysis of Jurkat cells, untreated (blue) or etoposide-treated (green) **(A)**, using #9661 compared to a nonspecific negative control antibody (red). Confocal IF analysis of HT-29 cells, untreated **(B)** or treated with Staurosporine #9953 **(C)**, using #9661 (green). Actin filaments were labeled using DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).





APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

Selected Application References:

Caspase-1 Antibody #2225: Feng, Q. et al. (2005) *Cancer Res.* 65, 8591–8596. (W)

Cleaved Caspase-3 (Asp175) Antibody #9661: Goodyear, C.S. et al. (2004) *J. Immunol.* 172, 2870–2877. (F) / Kaiser, C.L. et al. (2008) *Hear. Res.* 240, 1–11. (IHC-P)

Cleaved Caspase-3 (Asp175) (5A1) Rabbit mAb #9664: Wada-Hiraike, O. et al. (2006) *Proc. Natl. Acad. Sci. USA* 103, 2959–2964. (IHC) / Martel, V. et al. (2006) *Oncogene* 25, 7343–7353. (IF-IC) / Cai, C. et al. (2006) *J. Biol. Chem.* 281, 16649–16655. (W)

Caspase-3 Antibody #9662: Chandrasekar, B. et al. (2004) *J. Biol. Chem.* 279, 20221–20233. (W) / Hara, H. et al. (2002) *J. Immunol.* 168, 2288–2295. (W) / Yu, L. et al. (2002) *EMBO J.* 21, 3749–3759. (W)

Caspase-3 (8G10) Rabbit mAb #9665: Su, J. et al. (2006) *J. Virol.* 80, 1140–1151. (W) / Tahmatzopoulos, A. et al. (2005) *Oncogene* 24, 5375–5383. (W) / Carrero, J.A. et al. (2004) *J. Immunol.* 172, 4866–4874. (W)

Cleaved Caspase-6 (Asp162) Antibody #9761: Bhakar, A. L. et al. (2003) *J. Neurosci.* 23, 11373–11381. (W)

Caspase-6 Antibody #9762: Hara, H. et al. (2002) *J. Immunol.* 168, 2288–2295. (W) / Le, D.A. et al. (2002) *Proc. Natl. Acad. Sci. USA* 99, 15188–15193. (W) / Schroder, A. et al. (2002) *J. Immunol.* 168, 996–1000. (W)

Cleaved Caspase-7 (Asp198) Antibody #9491: Han, H. et al. (2001) *J. Biol. Chem.* 276, 26357–26364. (W)

Caspase-7 Antibody #9492: Lademann, U. et al. (2003) *Mol. Cell. Biol.* 23, 7829–7837. (W) / Erhardt, J.A. et al. (2001) *Thromb. Res.* 103, 143–148. (W)

Cleaved Caspase-8 (Asp384) (11G10) Mouse mAb #9748: Cheong, J-W. et al. (2003) *Clin. Cancer Res.* 9, 5018–5027. (W)

Caspase-8 (1C12) Mouse mAb #9746: Jeong, W. et al. (2004) *J. Biol. Chem.* 279, 3151–3159. (W) / Ballestrero, A. et al. (2004) *Clin. Cancer Res.* 10, 1463–1470. (W) / Mongini, P.K.A. et al. (2003) *J. Immunol.* 171, 5244–5254. (W)

Cleaved Caspase-9 (Asp315) Antibody (Human Specific) #9505: Kaiser, C.L. et al. (2008) *Hear. Res.* 240, 1–11. (IHC-P) Cheong, J-W. et al. (2003) *Clin. Cancer Res.* 9, 5018–5027. (W) / Mitchell, K.O. et al. (2000) *Cancer Res.* 60, 6318–6325. (W)

Cleaved Caspase-9 (Asp353) Antibody (Rat Specific) #9507: Guimarães, C.A. et al. (2003) *J. Biol. Chem.* 278, 41938–41946. (IC)

Cleaved Caspase-9 (Asp353) Antibody (Mouse Specific) #9509: Kim, I.Y. et al. (2002) *Cancer Res.* 62, 3649–3653. (W) / Monick, M.M. et al. (2006) *J. Immunol.* 177, 1636–1645. (W)

Caspase-9 Antibody (Human Specific) #9502: Chandrasekar, B. et al. (2004) *J. Biol. Chem.* 279, 20221–20233. (W) / Yu, W. et al. (2003) *Cancer Res.* 63, 2483–2491. (W) / Bhakar, A.L. et al. (2003) *J. Neurosci.* 23, 11373–11381. (W)

Caspase-9 Antibody (Mouse Specific) #9504: Katoh, I. et al. (2004) *J. Biol. Chem.* 279, 15515–15523. (W) / Ekert, P.G. et al. (2004) *J. Cell Biol.* 165, 835–842. (W) / Denecker, G. et al. (2001) *J. Biol. Chem.* 276, 19706–19714. (W)

Caspase-9 Antibody (Rat Specific) #9506: Deming, P.B. et al. (2004) *Mol. Cell Biol.* 24, 10289–10299. (W) / Penchalaneni, J. et al. (2004) *Biol. Reprod.* 71, 1475–1483. (W) / Marques, C.A. et al. (2003) *J. Biol. Chem.* 278, 28294–28302. (W)

Caspase-10 Antibody #9752: Penchalaneni, J. et al. (2004) *Biol. Reprod.* 71, 1475–1483. (W)

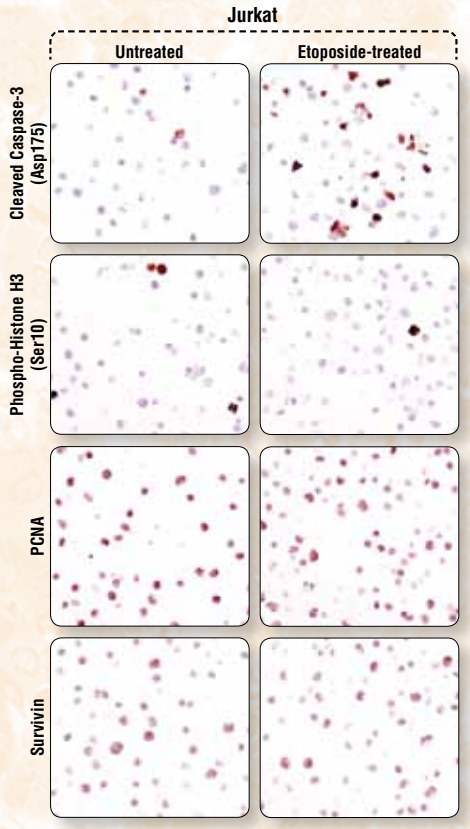
Caspase-12 Antibody #2202: Li, J. et al. (2006) *J. Biol. Chem.* 281, 7260–7270. (W) / Sanvicens, N. et al. (2004) *J. Biol. Chem.* 279, 39268–39278. (W) / Tsai, Y.C. et al. (2003) *J. Biol. Chem.* 278, 22044–22055. (W)

Unparalleled Product Quality, Validation, and Technical Support

Immunohistochemistry Apoptosis Kit

Cell Signaling Technology has developed an immunohistochemistry (IHC) kit specifically for the detection of proliferation and apoptosis. This kit is supported by our in-house IHC specialists, the same scientists who validated the product and know it best.

#8109 SignalStain® Proliferation/Apoptosis IHC Sampler Kit
Cleaved Caspase-3 (Asp175) Ab #9661, Phospho-Histone H3 (Ser10) Ab #9701, PCNA (PC10) Mouse mAb #2586, Survivin (71G4B7) Rabbit mAb #2808, SignalStain® Ab Diluent #8112, SignalSlide® Cleaved Caspase-3 (Asp175) IHC Controls #8104



SignalStain® Proliferation/Apoptosis IHC Sampler Kit #8109: IHC analysis of paraffin embedded Jurkat cell pellets, untreated (left) or etoposide-treated (right), using Phospho-Histone H3 (Ser10) Antibody, PCNA (PC10) Mouse mAb, Cleaved Caspase-3 (Asp175) Antibody, and Survivin (71G4B7E) Rabbit mAb. Cell pellets are provided in the SignalSlide® Cleaved Caspase-3 (Asp175) IHC Controls.

Caspase-3 Antibody Comparison

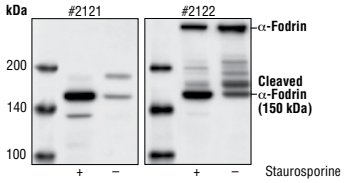
	Reactivity	WB	IP	IHC	Flow	IF
#9664 Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb	H, M, R, Mk, (Dg)	++++	++++	+++	+++	+++
#9654 Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb (Biotinylated)	H, M, R, Mk	++++	–	N/A	N/T	N/T
#9661 Cleaved Caspase-3 (Asp175) Antibody	H, M, R, Mk, B, (Pg, Dg)	++++	–	++++	++++	++++
#9669 Cleaved Caspase-3 (Asp175) Antibody (Alexa Fluor® 488 Conjugate)	H, M, R, Mk, B, (Pg)	N/A	N/A	N/A	++++	++
#9665 Caspase-3 (8G10) Rabbit mAb	H, M, R, Mk	++++	++++	–	–	–
#9662 Caspase-3 Antibody	H, M, R, Mk	+++	+++	++	–	–
#9668 Caspase-3 (3G2) Mouse mAb	H	+++	–	–	–	–

Testing Key: ++++ Very Highly Recommended / +++ Highly Recommended / ++ Recommended / – Not Recommended / N/T Not Tested / N/A Not Applicable

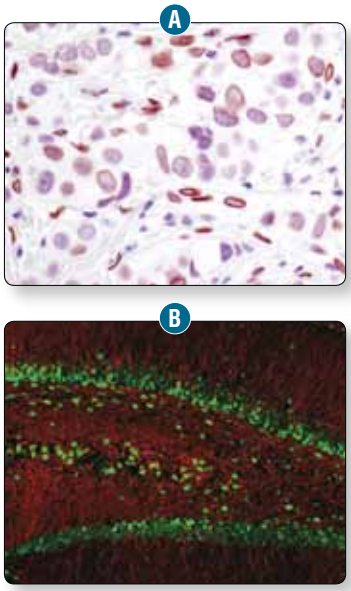
REACTIVITY KEY:
H human / **M** mouse / **R** rat / **Hm** hamster / **Mk** monkey / **C** chicken / **Mi** mink / **Dm** D. melanogaster / **X** Xenopus / **Z** zebra fish / **B** bovine / **Dg** dog / **Pg** pig / **Sc** S. cerevisiae / **All** all species expected / **( )** 100% sequence homology

Cleaved Substrates

Cleaved α-Fodrin (Asp1185) Antibody #2121: WB analysis of extracts from HeLa cells, untreated or staurosporine-treated, using #2121 (left) or α-Fodrin Antibody #2122 (right).



Lamin A/C (4C11) Mouse mAb #4777: IHC analysis of paraffin-embedded human breast carcinoma **(A)** using #4777. Confocal IF analysis of normal rat brain **(B)** using #4777 (green) and MAP2 Antibody #4542 (red).



			Applications	Reactivity
	#4934	Acinus Antibody	W, IF-IC	H, M, R, Mk
	#9731	Cleaved DFF45 (Asp224) Antibody	W	H
	#9732	DFF45/DFF35 Antibody	W, IP	H
	#2121	Cleaved α-Fodrin (Asp1185) Antibody	W	H
	#2122	α-Fodrin Antibody	W	H
	#2031	Cleaved Lamin A (Asp230) Antibody	W	H, M, R
	#2035	Cleaved Lamin A (Small Subunit) Antibody	W, IHC-P, IF-IC	H, M, R
	#2036	Cleaved Lamin A (Small Subunit) (30H5) Mouse mAb	W, IF-IC	H, M, R
	#2026	Phospho-Lamin A/C (Ser22) Antibody	W, IF-IC	H, M, R
	#2032	Lamin A/C Antibody	W, IHC-P	H, M, R, (B)
NEW	#4777	Lamin A/C (4C11) Mouse mAb	W, IP, IHC-P, IF-F, IF-IC, F	H, M, R, Mk
NEW	#5369	LAP2α (3A3) Mouse mAb	W, IF-IC	H, Mk
	#3681	Phospho-Mst1 (Thr183)/Mst2 (Thr180) Antibody	W	H, M, (R)
	#3682	Mst1 Antibody	W, IP	H, M, R, Mk, B
	#3952	Mst2 Antibody	W, IP	H, M, R, Mk, B
	#3723	Mst3 Antibody	W, F	H, M, R, Mk
	#4062	Mst3b Antibody	W	H, M, R, Mk, B
NEW	#5625	Cleaved PARP (Asp214) (D64E10) XP™ Rabbit mAb	W, IP, IF-IC, F	H, Mk
	#9541	Cleaved PARP (Asp214) Antibody (Human Specific)	W, IHC-P, IF-IC, F	H
	#9547	Cleaved PARP (Asp214) Antibody (Human Specific) (Fluorescein Conjugate)	IF-IC	H
	#9544	Cleaved PARP (Asp214) Antibody (Mouse Specific)	W, IF-IC	M
	#9545	Cleaved PARP (Asp214) Antibody (Rat Specific)	W	R
	#9546	Cleaved PARP (Asp214) (19F4) Mouse mAb (Human Specific)	W	H
	#9548	Cleaved PARP (Asp214) (7C9) Mouse mAb (Mouse Specific)	W	M
	#9532	PARP (46D11) Rabbit mAb	W, IP, IF-IC	H, M, R, Mk
NEW	#6704	PARP (46D11) Rabbit mAb (Sepharose Bead Conjugate)	IP	H, M, R, Mk
	#9542	PARP Antibody	W	H, M, R, Mk

Selected Application References:

DFF45/DFF35 Antibody #9732:
Ishitsuka, K. et al. (2005) *Oncogene* 24, 5888–5896. (W)
Jendrossek, V. et al. (2003) *Oncogene* 22, 2621–2631. (W)

Cleaved IL-1β (Asp116) Antibody #2021:
Martinon, F. et al. (2002) *Mol. Cell* 10, 417–426. (W)

IL-1β Antibody #2022:
Basak, C. et al. (2005) *J. Biol. Chem.* 280, 4279–4288. (WB)

Cleaved Lamin A (Asp230) Antibody #2031:
Yamanaka, K. et al. (2005) *Mol. Cancer Ther.* 4, 1689–1698. (W)

Cleaved Lamin A (Small Subunit) Antibody #2035:
Martensson, K. et al. (2004) *J. Bone Miner. Res.* 19, 1805–1812. (IHC)

Lamin A/C Antibody #2032:
Dentin, R. et al. (2004) *J. Biol. Chem.* 279, 20314–20326. (W)
Charniot, J.C. et al. (2003) *Hum. Mutat.* 21, 473–481. (IF-IC)
Sun, S. et al. (2002) *Cancer Res.* 62, 2430–2436. (W)
Kim, K. et al. (2002) *Mol. Cancer Ther.* 1, 177–184. (W)

Cleaved PARP (Asp214) Antibody (Human Specific) #9541:
Bhakar, A.L. et al. (2003) *J. Neurosci.* 23, 11373–11381. (W)
Jiang, C. et al. (2001) *Cancer Res.* 61, 3062–3070. (W)
Brunet, A. et al. (2001) *Mol. Cell. Biol.* 21, 952–965. (W)

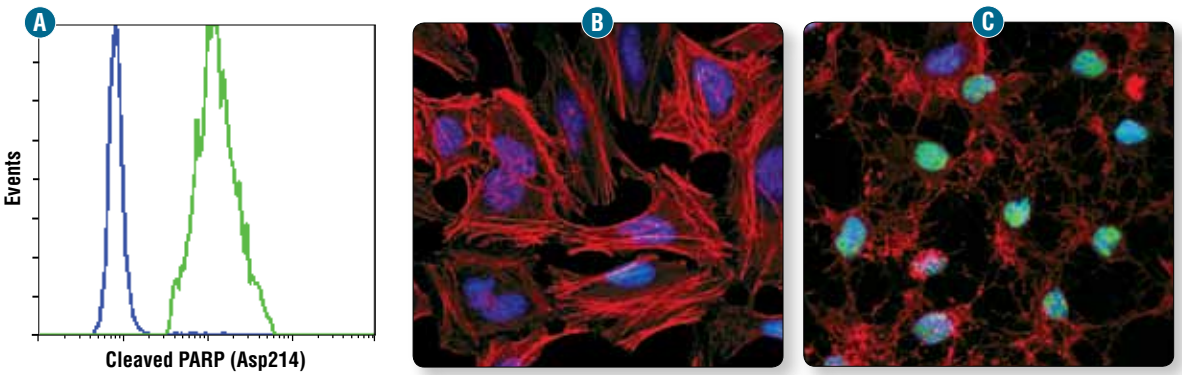
Cleaved PARP (Asp214) Antibody (Rat Specific) #9545:
Han, H. et al. (2001) *J. Biol. Chem.* 276, 26357–26364. (W)
Au-Yeung, K.W. et al. (2001) *Bio. Pharmacol.* 62, 483–493. (W)
Erhardt, J.A. et al. (2001) *Thromb. Res.* 103, 143–148. (W)

Cleaved PARP (Asp214) (19F4) Mouse mAb (Human Specific) #9546:
Shukla, S. et al. (2005) *FASEB J.* 19, 2042–2044. (IHC)
Reboredo, M. et al. (2004) *J. Gen. Virol.* 85, 3555–3567. (W)

Cleaved PARP (Asp214) (7C9) Mouse mAb (Mouse Specific) #9548:
Nishigaki, K. et al. (2003) *J. Biol. Chem.* 278, 13520–13530. (W)

PARP Antibody #9542:
Chandrasekar, B. et al. (2004) *J. Biol. Chem.* 279, 20221–20233. (W)
Kumar–Sinha, C. et al. (2003) *Cancer Res.* 63, 132–139. (W)
Li, J. et al. (2002) *J. Biol. Chem.* 277, 388–394. (W)

Cleaved-PARP (Asp214) (D64E10) XP™ Rabbit mAb #5625: Flow cytometric analysis of Jurkat cells, untreated (blue) or etoposide-treated (green) **(A)**, using #5625. Confocal IF analysis of HeLa cells, untreated **(B)** or treated with Staurosporine #9953 **(C)**, using #5625 (green). Actin filaments were labeled using DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).



APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

What does Antibody Validation mean at Cell Signaling Technology?

Scientists at Cell Signaling Technology follow a stringent validation protocol using a combination of several approaches and applications to provide you with the highest quality antibodies. This ensures credible and reproducible results with the least expenditure of your precious time, samples, and reagents.

Antibody Validation at Cell Signaling Technology includes:

Testing in a Number of Applications to help you choose the antibody that works best in your experiment.

- Western blot, Immunoprecipitation, Immunohistochemistry, Immunofluorescence, Flow cytometry, ChIP, Sandwich ELISA

Verifying Specificity and Reproducibility to ensure that the antibody performs consistently in all applications specified.

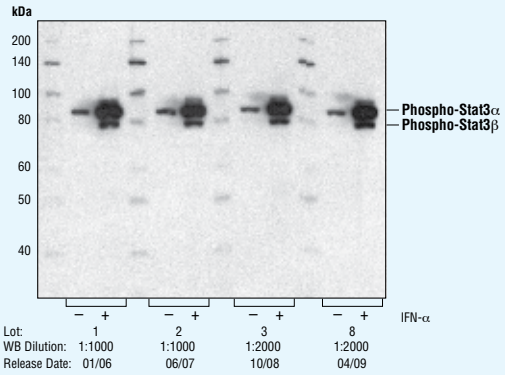
- Treatment of cells with appropriate kinase-specific inhibitors to verify specificity
- Analysis of a large panel of cell lines and species with known target expression levels to confirm target specificity
- Phosphatase treatment to verify phospho-specificity
- Comparison of antibody to isotype control antibody
- Verification of target-specific signal in transfected cells, knock-out cells, or siRNA-treated cells
- Blocking with antigen peptide
- Verification of correct subcellular localization or treatment-induced translocation
- Side-by-side comparison of a new lot with previous lots to ensure lot-to-lot consistency

Identifying Optimal Conditions to save your precious time, samples, and reagents.

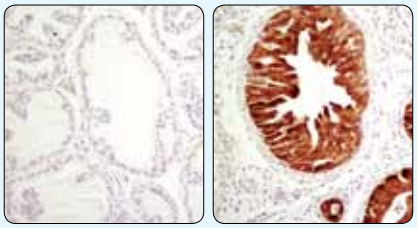
- Optimal dilutions and buffers are predetermined
- Positive and negative control cell extracts are specified
- Detailed protocols are already optimized

Side-by-side comparison of new lot with previous lots

Phospho-Stat3 (Tyr705) (D3A7) XP™ Rabbit mAb #9145: WB analysis of HeLa cells, untreated or treated with IFN-α; comparing lot 1, 2, 3, and 8 of #9145, showing that signal remains consistent from lot-to-lot. Note: Recommended dilution for western blot was changed to 1:2000 with release of lot 3.

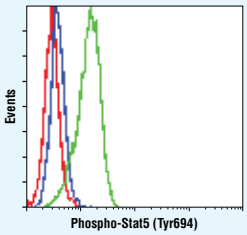


Verification of target-specificity using mouse models



Phospho-Akt (Ser473) (D9E) XP™ Rabbit mAb #4060: IHC analysis of paraffin-embedded WT (left) and PTEN (-/-) (right) mouse prostate using #4060. Tissue courtesy of Dr. David Guertin, The Whitehead Institute for Biomedical Research, Cambridge, MA.

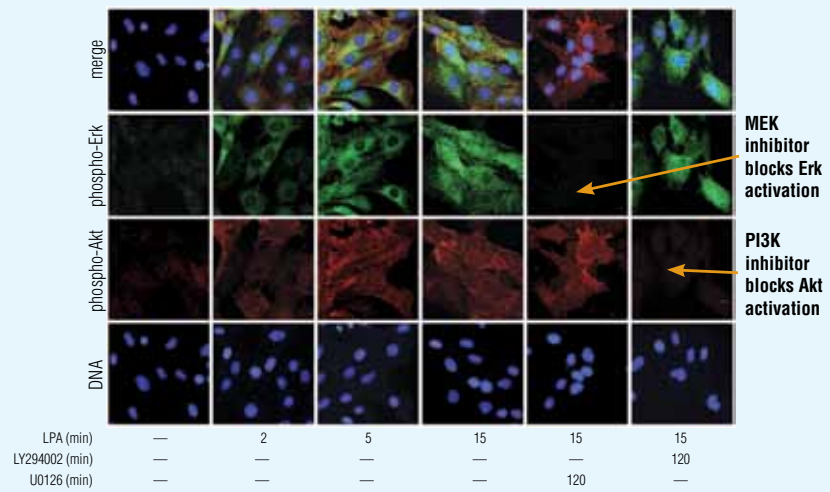
Comparison of target-specific antibody to non-specific isotype control



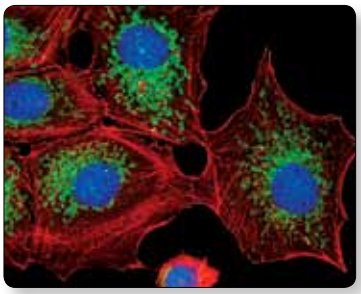
Phospho-Stat5 (Tyr694) (C71E5) Rabbit mAb #9314: Flow cytometric analysis of K-562 cells, untreated (green) or gefitinib-treated (blue), using #9314 compared to concentration matched Rabbit (DA1E) mAb IgG XP™ Isotype Control #3900 (red).

Verification of specificity using known target activators and inhibitors

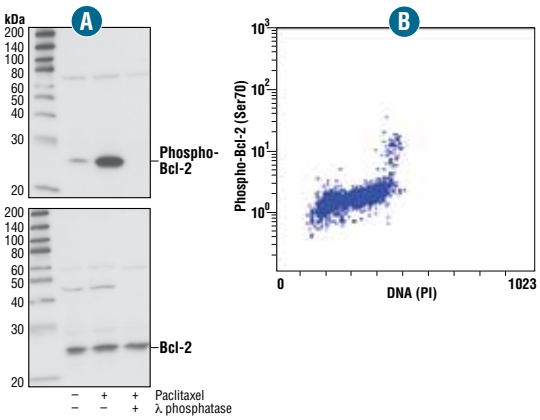
Confocal IF analysis of C6 (rat glioma) cells stimulated with lysophosphatidic acid (LPA), following pretreatment with kinase specific inhibitors LY294002 #9901 or U0126 #9903 for the indicated times.



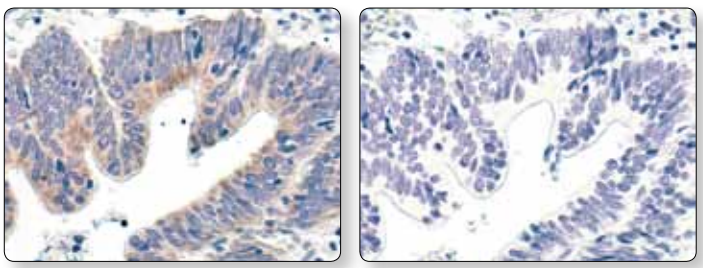
Bcl-2 Family Members



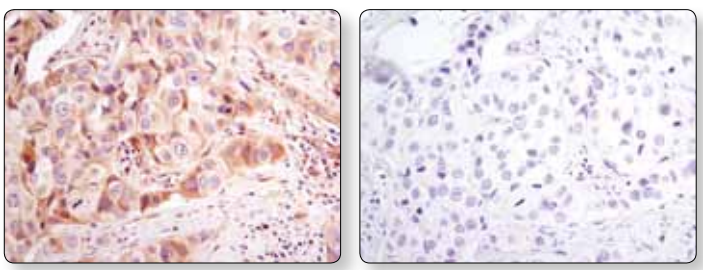
Bim Antibody #2819: Confocal IF analysis of HeLa cells using #2819 (green). Actin filaments were labeled with Alexa Fluor® 555 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).



Phospho-Bcl-2 (Ser70) (5H2) Rabbit mAb #2827: WB analysis of extracts from Jurkat cells, untreated or treated with paclitaxel (1 µM, overnight) and with or without λ phosphatase **(A)**, using #2827. Flow cytometric analysis of Jurkat cells **(B)** using #2827, versus propidium iodide (DNA content).



Bcl-xL (54H6) Rabbit mAb #2764: IHC analysis of paraffin-embedded human colon carcinoma using #2764 in the presence of control peptide (left) or Bcl-xL Blocking Peptide #1225 (right).

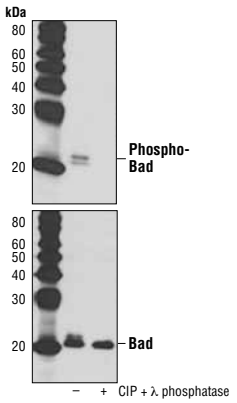


Bax (D2E11) Rabbit mAb #5023: IHC analysis of paraffin-embedded human breast carcinoma using #5023 in the presence of control peptide (left) or antigen-specific peptide (right).

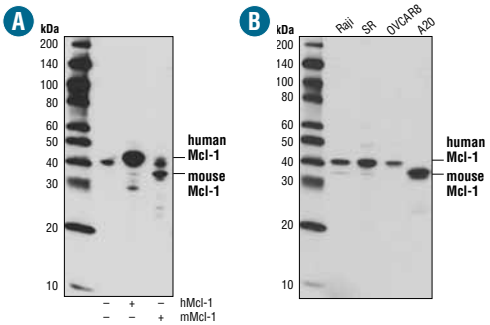
		Applications	Reactivity
	#4647 A1/Bfl-1 Antibody	W, IP	H, (M, R)
	#5284 Phospho-Bad (Ser112) (40A9) Rabbit mAb	W, IHC-P, F	H, M, R, Mk
	#9291 Phospho-Bad (Ser112) Antibody	W, IP, F, E-P	H, M, R, Mk
	#9296 Phospho-Bad (Ser112) (7E11) Mouse mAb	W	H, M, R, Mk
NEW	**#4366 Phospho-Bad (Ser136) (D25H8) Rabbit mAb**	W, IP	H, M, Mk, (R)
	#5286 Phospho-Bad (Ser136) (185D10) Rabbit mAb	W	M, Mk, (H, R)
	#9295 Phospho-Bad (Ser136) Antibody	W	M, (H, R)
	#9297 Phospho-Bad (Ser155) Antibody	W, E-P	H, M
	#9239 Bad (D24A9) Rabbit mAb	W	H, M, R, Mk
	#9268 Bad (11E3) Rabbit mAb (IP Preferred)	W, IP	H, M, R, (Mk)
	#9292 Bad Antibody	W, IP	H, M, R, Mk
	#3814 Bak Antibody	W	H, M, R, Mk
NEW	**#5023 Bax (D2E11) Rabbit mAb**	W, IP, IHC-P	H
	#2772 Bax Antibody	W, IP	H, M, R, Mk
	#2774 Bax Antibody (Human Specific)	W, IP, IHC-P	H, Mk
	#2875 Phospho-Bcl-2 (Thr56) Antibody (Human Specific)	W	H
	#2827 Phospho-Bcl-2 (Ser70) (5H2) Rabbit mAb	W, IF-IC, F	H
	#2834 Phospho-Bcl-2 (Ser70) (5H2) Rabbit mAb (Alexa Fluor® 488 Conjugate)	F	H
	#4223 Bcl-2 (D55G8) Rabbit mAb (Human Specific)	W, IP	H
	#3498 Bcl-2 (D17C4) Rabbit mAb (Mouse Preferred)	W, IP	H, M
	#2870 Bcl-2 (50E3) Rabbit mAb	W, IP	H, M, R, (Mk, C, B, Dg)
	#2876 Bcl-2 Antibody	W	H, M, R
	#2872 Bcl-2 Antibody (Human Specific)	W	H
	#3869 BCL2L10 Antibody	W	H, M, R, Mk
	#2724 Bcl-w (31H4) Rabbit mAb	W	H, M, R
	#2764 Bcl-xL (54H6) Rabbit mAb	W, IP, IHC-P, IHC-F, IF-IC	H, M, R, Mk
	#2767 Bcl-xL (54H6) Rabbit mAb (Alexa Fluor® 488 Conjugate)	F	H, M, R
	#2762 Bcl-xL Antibody	W, IP, IHC-P	H, M, R, Mk
	#2002 BID Antibody (Human Specific)	W, IP	H
	#2003 BID Antibody (Mouse Specific)	W	M
	#2006 BID (7A3) Mouse mAb (Human Specific)	W	H
	#4592 Bik Antibody	W, IHC-P	H
	#4550 Phospho-Bim (Ser55) Antibody	W	M, (H, R)
	#4585 Phospho-Bim (Ser69) (D7E11) Rabbit mAb	W, IP	H, M, (R, Mk, Dg)
	#4581 Phospho-Bim (Ser69) Antibody	W, IP	H, M, (R, Mk, Dg)
	#2933 Bim (C34C5) Rabbit mAb	W, IP, IHC-P, IF-IC, F	H, M, R, (Mk, B, Dg)
	#2819 Bim Antibody	W, IP, IF-IC, F	H, M, R, (Mk)
	#3769 BNIP3 Antibody (Rodent Specific)	W	M, R
	#4521 Bok Antibody	W	H, M, R, Mk
NEW	**#5889 Bmf (G81) Antibody**	W	H, M, R
	#4579 Phospho-Mcl-1 (Ser159/Thr163) Antibody	W, IP	H
NEW	**#5453 Mcl-1 (D35A5) Rabbit mAb**	W	H, M, (Mk, B)
	#4572 Mcl-1 Antibody	W	H
	#4976 Puma Antibody	W	H, (Mk)

APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

Phospho-Bad (Ser136) (D25H8) Rabbit mAb #4366: WB analysis of extracts from COS-7 cells, treated with hEGF #8916 (100 ng/ml, 30 min.) in the presence or absence of λ phosphatase and calf intestinal phosphatase (CIP), using #4366 or Bad (D24A9) Rabbit mAb #9239 (lower).



Mcl-1 (D35A5) Rabbit mAb #5453: WB analysis of extracts from 293T cells, mock transfected or transfected with human or mouse Mcl-1 constructs **(A)**, using #5453. WB analysis of extracts from various cell lines **(B)** using #5453.



Selected Application References:

Phospho-Bad (Ser112) Antibody #9291: Gray, M.J. et al. (2008) *J. Natl Cancer Inst.* 100, 109–120. (W) / Fujita, H. et al. (2005) *Biochem. Pharmacol.* 69, 1773–1784. (W) / Jamieson, C.A. and Yamamoto, K.R. (2000) *Proc. Natl. Acad. Sci. USA* 97, 7319–7324. (W) / Bertolotto, C. et al. (2000) *J. Biol. Chem.* 275, 37246–37250. (W) / Tan, Y. et al. (1999) *J. Biol. Chem.* 274, 34859–34867. (W)

Phospho-Bad (Ser112) (7E11) Mouse mAb #9296: Avota, E. et al. (2001) *Nat. Med.* 7, 725–731. (W) / Bieberich, E. et al. (2001) *J. Biol. Chem.* 276, 44396–44404. (W)

Phospho-Bad (Ser136) Antibody #9295: Gray, M.J. et al. (2008) *J. Natl. Cancer Inst.* 100, 109–120. (W) / Fujita, H. et al. (2005) *Biochem. Pharmacol.* 69, 1773–1784. (W) / Rusiñol, A.E. et al. (2004) *J. Biol. Chem.* 279, 1392–1399. (W) / Yang, C–C. et al. (2003) *J. Biol. Chem.* 278, 25872–25878. (W)

Phospho-Bad (Ser155) Antibody #9297: Saito, A. et al. (2003) *J. Neurosci.* 23, 1710–1718. (W) / Yusta, B. et al. (2002) *J. Biol. Chem.* 277, 24896–24906. (W) / Tan, Y. et al. (2000) *J. Biol. Chem.* 275, 25865–25869. (W)

Bad Antibody #9292: Gray, M.J. et al. (2008) *J. Natl. Cancer Inst.* 100, 109–120. (W) / Liu, C. et al. (2003) *Cancer Res.* 63, 3138–3144. (W, IP) / Saito, A. et al. (2003) *J. Neurosci.* 23, 1710–1718. (W) / Yu, C. et al. (2003) *Cancer Res.* 63, 1822–1833. (W)

Bax Antibody #2772: Yang, L. et al. (2004) *J. Biol. Chem.* 279, 11639–11648. (W) / Rusiñol, A.E. et al. (2004) *J. Biol. Chem.* 279, 1392–1399. (W) / Leu, J. et al. (2004) *Nat. Cell Biol.* 6, 443–450. (W, IP) / Cheong, J-W. et al. (2003) *Clin. Cancer Res.* 9, 5018–5027. (W)

Bcl-2 Antibody #2876: Yang, Y.M. et al. (2005) *Cancer Res.* 65, 8538–8547. (W) / Yang, L. et al. (2004) *J. Biol. Chem.* 279, 11639–11648. (W)

Bcl-2 Antibody (Human Specific) #2872: Samanta, A.K. et al. (2004) *J. Biol. Chem.* 279, 7576–7583. (W)

Bcl-xL Antibody #2762: Leu, J. et al. (2004) *Nat. Cell Biol.* 6, 443–450. (W, IP) / Saito, A. et al. (2003) *J. Neurosci.* 23, 1710–1718. (W, IHC) / Yang, C-C. et al. (2003) *J. Biol. Chem.* 278, 25872–25878. (W)

BID Antibody (Human Specific) #2002: Ogino, T. et al. (2009) *Leuk. Res.* 33, 151–158. (W) / Abdelrahim, M. et al. (2006) *Carcinogenesis* 27, 717–728. (W) / Weng, C. et al. (2005) *J. Biol. Chem.* 280, 10491–10500. (W) / Chandrasekar, B. et al. (2004) *J. Biol. Chem.* 279, 20221–20233. (W)

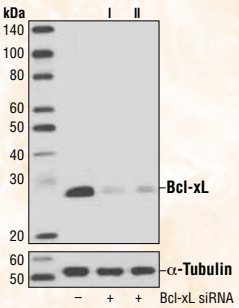
Mcl-1 Antibody #4572: Ocio, E.M. et al. (2009) *Blood* 113, 3781–3791. (W) / Roccaro, A.M. et al. (2008) *Clin. Cancer Res.* 14, 1849–58. (W) / Roccaro, A.M. et al. (2008) *Blood* 111, 4752–4763. (W) / Kashkar, H. et al. (2007) *Blood* 109, 3982–3988. (W) / Gulmann, C. et al. (2005) *Clin. Cancer Res.* 11, 5847–5855. (W)

SignalSilence® siRNA

SignalSilence® siRNA duplexes from Cell Signaling Technology (CST) allow the researcher to specifically inhibit protein expression. These products utilize RNA interference, a method in which gene expression can be selectively silenced through the delivery of double stranded RNA molecules into the cell. Two siRNAs are now available for most targets (siRNA I and II). A fluorescein-labeled non-targeted siRNA control allows the user to monitor transfection efficiency. In addition, an unconjugated control siRNA can be used to control for specific protein inhibition.

- siRNA duplexes are designed, produced, and purified in-house – siRNA products are held to the same stringent quality control standards as CST™ antibody products.
- siRNA duplexes are used in-house for antibody validation – effective knockdown is assessed by scientists at Cell Signaling Technology at the protein level.
- Technical support is provided by the same scientists who produce and validate the products – you have access to our knowledgeable technical support scientists to discuss transfection methods or any other questions.

Targets	I	II
Atg4B NEW	#6336	–
Atg4C NEW	#6325	–
Atg5 NEW	#6345	–
Atg7 NEW	#6604	–
Atg14 NEW	#6286	#6287
Bad	#6471	#6512
Bax	#6321	#6514
Bcl-2	#6441	#6516
Bcl-xL NEW	#6362	#6363
Beclin-1 NEW	#6222	#6246
Bim	#6461	#6518
Caspase-3	#6466	#6520
Caspase-10 NEW	#6357	–
LC3A NEW	#6214	#6215
LC3B NEW	#6212	#6213
Mcl-1 NEW	#6315	–
c-Myc	#6341	#6552
NDRG1 NEW	#6245	#6257
NF-κB p65	#6261	#6534
p53	#6231	#6562
PARP NEW	#6304	#6305
Survivin	#6351	#6546
XIAP	#6446	#6550
Control (Unconjugated)	#6568	–
Control (Fluorescein Conjugate)	#6201	–



SignalSilence® Bcl-xL siRNA I #6362 and siRNA II #6363: WB analysis of extracts from HeLa cells, transfected with 100 nM SignalSilence® Control siRNA (Unconjugated) #6568 (-), #6362 (+), or #6363 (+), using Bcl-xL (54H6) Rabbit mAb #2764 (upper) or α-Tubulin (11H10) Rabbit mAb #2125 (lower). The Bcl-xL (54H6) Rabbit mAb confirms silencing of Bcl-xL expression, while the α-Tubulin (11H10) Rabbit mAb is used as a loading control.

Visit our website for a complete listing of SignalSilence® siRNA products.

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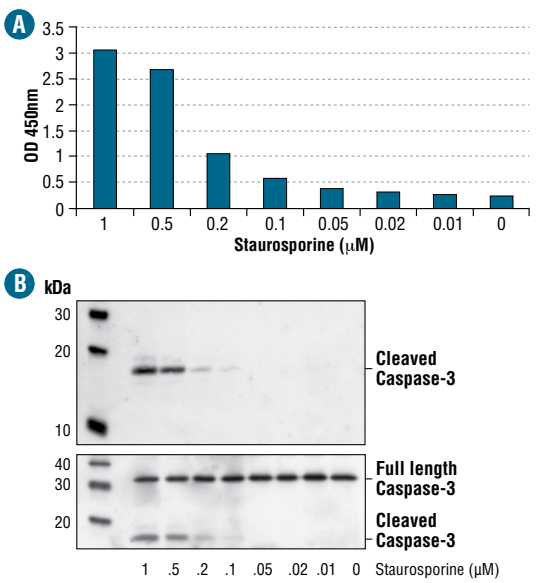
PathScan® ELISA Kits and Antibody Pairs

Our line of PathScan® ELISA products provides researchers with a selection of assays for the study of critical regulatory proteins. In-house development, production, and validation of these kits ensure the highest possible product quality and support. Contact us to find out more on pricing and availability of custom ELISA products. Antibody pairs provide scientists with an economical alternative to our complete PathScan® ELISA kits.

PathScan® Sandwich ELISA Kits		Antibody Pair
#7182	PathScan® Phospho-Bad (Ser112) Sandwich ELISA Kit	#7842
#7162	PathScan® Total Bad Sandwich ELISA Kit	#7840
#7190	PathScan® Cleaved Caspase-3 (Asp175) Sandwich ELISA Kit	–
#7173	PathScan® Phospho-NF-κB p65 (Ser536) Sandwich ELISA Kit	#7834
#7174	PathScan® Total NF-κB p65 Sandwich ELISA Kit	#7836
#7236	PathScan® Acetylated p53 Sandwich ELISA Kit	#7848
#7365	PathScan® Phospho-p53 (Ser15) Sandwich ELISA Kit	#7846
#7370	PathScan® Total p53 Sandwich ELISA Kit	#7844
#7262	PathScan® Cleaved PARP (Asp214) Sandwich ELISA Kit	#7858
#7169	PathScan® Total Survivin Sandwich ELISA Kit	–

PathScan® Multi-Target Sandwich ELISA Kits

#7105 Kits include reagents to detect levels of: phospho-p53 (Ser15), p53, phosph-Bad (Ser112), Bad, Cleaved Caspase-3 (Asp175), and Cleaved PARP (Asp214).



PathScan® Cleaved Caspase-3 (Asp175) Sandwich ELISA Kit #7190: Treatment of HeLa cells with staurosporine stimulates cleavage of caspase-3 protein, detected by #7190 **(A)**, but does not affect the level of total caspase-3 protein detected by western blot **(B)**, using Cleaved Caspase-3 (Asp175) Antibody #9661 (upper panel) or Caspase-3 Antibody #9662 (lower panel).

Unparalleled Product Quality, Validation, and Technical Support

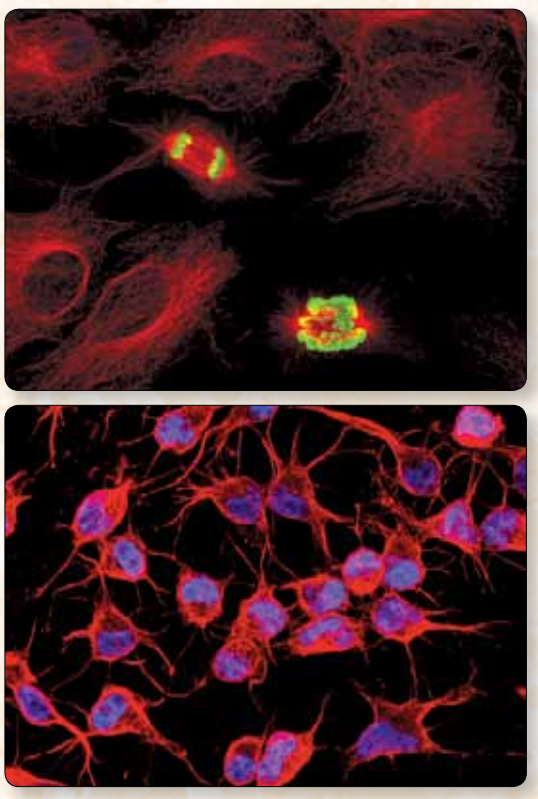
PathScan® Multiplex IF Kit

PathScan® Apoptosis and Proliferation Multiplex IF Kit from Cell Signaling Technology offers a novel multiplex assay to simultaneously monitor mitotic index and programmed cell death using automated imaging or laser scanning high content platforms, or manual immunofluorescence (IF) microscopy. This kit contains a cocktail of three primary antibodies targeted against α-Tubulin, phospho-Histone H3 (Ser10), and cleaved PARP (Asp214), as well as a detection cocktail utilizing the Alexa Fluor® series of fluorescent dyes. Antibody and dye pairings have been pre-optimized, and each kit contains reagents necessary to perform 100 assays (based on 100 µl assay volume).

- Kit allows the analysis of multiple pathway endpoints within a single sample, saving time and reagents.
- Kit is produced and optimized in-house with the highest quality antibodies, providing you with the greatest possible specificity and sensitivity.
- Technical support is provided by our in-house IF group who developed the product and knows it best.

PathScan® Multiplex IF Kits

#7851 PathScan® Apoptosis and Proliferation Multiplex IF Kit
Kit include reagents to detect levels of: Phospho-Histone H3 (Ser10), Cleaved PARP (Asp214), and α-Tubulin



PathScan® Apoptosis and Proliferation Multiplex IF Kit #7851: Confocal IF analysis of HeLa cells, untreated (top) or treated with Staurosporine #9953 (bottom) using #7851. Red = α-tubulin, green = phospho-Histone H3 (Ser10), and blue = cleaved PARP (Asp214).

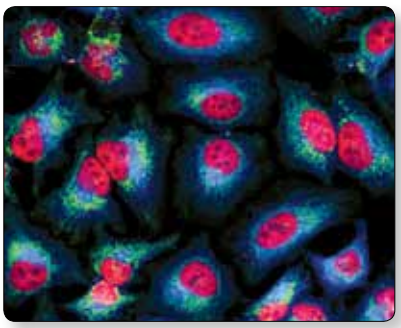
APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

Apoptosis Inhibitor Proteins

		Applications	Reactivity
	#4952 c-IAP1 Antibody	W	H, M, R
	#3130 c-IAP2 (58C7) Rabbit mAb	W, IP	H, (Mk)
NEW	**#5471 Livin (D61D1) XP™ Rabbit mAb**	W, IP, IF-IC	H
	#2808 Survivin (71G4B7) Rabbit mAb	W, IP, IHC-P, IHC-F, IF-IC, F	H, M, R
	#2810 Survivin (71G4B7) Rabbit mAb (Alexa Fluor® 488 Conjugate)	IF-IC, F	H, M, R
NEW	**#4580 Survivin (71G4B7) Rabbit mAb (Alexa Fluor® 555 Conjugate)**	IF-IC	H, M, R
	#2866 Survivin (71G4B7) Rabbit mAb (Alexa Fluor® 647 Conjugate)	F	H, M, R
NEW	**#3947 Survivin (71G4B7) Rabbit mAb (Sepharose Bead Conjugate)**	IP	H, M, R
NEW	**#4037 Survivin (71G4B7) Rabbit mAb (Biotinylated)**	W, F	H, M, R
	#2803 Survivin Antibody	W, IP	H
	#2802 Survivin (6E4) Mouse mAb	W	H, Mk
	#2045 XIAP (3B6) Rabbit mAb	W	H, Mk
	#2042 XIAP Antibody	W	H, M, R, Mk

Selected Application References:

XIAP Antibody #2042: Rosato, R.R. et al. (2003) *Mol. Cancer Ther.* 2, 1273–1284. (W) / Guegan, C. et al. (2001) *J. Neurosci.* 2, 6569–6576. (W)

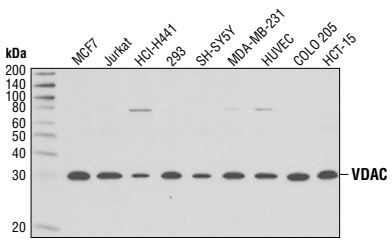


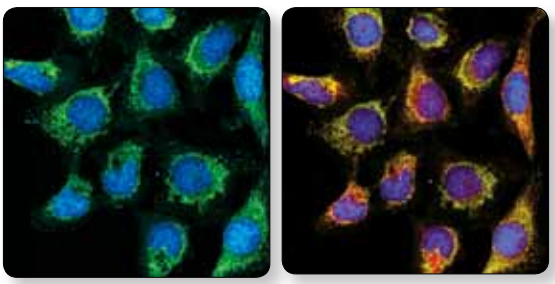
Survivin (71G4B7) Rabbit mAb (Alexa Fluor® 555 Conjugate) #4580: Confocal IF analysis of HeLa cells using #4580 (red), COX IV (3E11) Rabbit mAb (Alexa Fluor® 488 Conjugate) #4853 (green), and β-Tubulin (9F3) Rabbit mAb (Alexa Fluor® 647 Conjugate) #3624 (blue).

Mitochondrial Proteins

		Applications	Reactivity
NEW	**#5318 AIF (D39D2) XP™ Rabbit mAb**	W, IP, IF-IC	H, M, R, Mk, (B, Dg)
	#4642 AIF Antibody	W, IP, IHC-P, IF-IC	H, M, R
	#3543 Bit1 Antibody	W	H
	#4850 COX IV (3E11) Rabbit mAb	W, IP, IHC-P, IF-IC, F	H, R, Mk, Z, B, Pg
NEW	**#4853 COX IV (3E11) Rabbit mAb (Alexa Fluor® 488 Conjugate)**	IF-F, IF-IC, F	H, R, Mk, Z, B, Pg
NEW	**#5247 COX IV (3E11) Rabbit mAb (HRP Conjugate)**	W	H, R, Mk, Z, B, Pg
	#4844 COX IV Antibody	W, IP, IHC-P, IF-IC, F	H, M, R, Mk, B
	#4280 Cytochrome c (136F3) Rabbit mAb	W, IHC-P	H, M, R, Mk
	#4272 Cytochrome c Antibody	W, IHC-P	H, M, R, Mk, Dm, (B)
	#4969 Endonuclease G Antibody	W	H, M, R, (Mk)
	#2176 HtrA2 Antibody	W	H, M, R, Mk, (Dg)
NEW	**#5844 RMP Antibody**	W, IP	H, M, R, Mk
	#2954 Smac/Diablo Mouse mAb	W, IP, IHC-P, IF-IC	H, Mk
	#2429 Thioredoxin 1 (C63C6) Rabbit mAb	W, IHC-P	H, M, R
	#2285 Thioredoxin 1 Antibody (Human Specific)	W	H
	#2298 Thioredoxin 1 Antibody (Mouse/Rat Preferred)	W	M, R
	#4775 Tid-1 (RS13) Mouse mAb	W, IP	H, M, R
NEW	**#4661 VDAC (D73D12) Rabbit mAb**	W	H, M, R, Mk
	#4866 VDAC Antibody	W, IHC-P	H, M, R, B

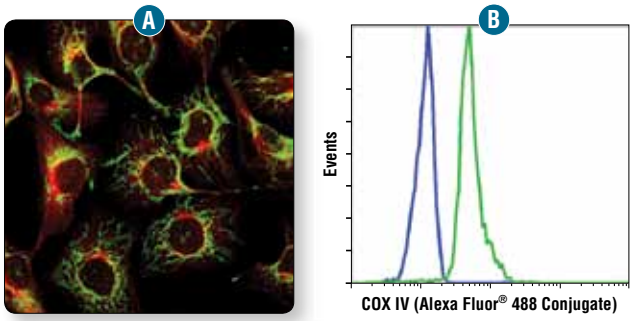
VDAC (D73D12) Rabbit mAb #4661: WB analysis of extracts from various cell lines using #4661.





AIF (D39D2) XP™ Rabbit mAb #5318: Confocal IF analysis of HeLa cells using #5318 (green, left), showing colocalization with mitochondria that have been labeled with MitoTracker® Red CMXRos (red, right). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).

COX IV (3E11) Rabbit mAb (Alexa Fluor® 488 Conjugate) #4853: Confocal IF analysis of SKOV3 cells **(A)** using #4853 (green) and β-Tubulin (9F3) Rabbit mAb (Alexa Fluor® 555 Conjugate) #2116 (red). Flow cytometric analysis **(B)** of NIH/3T3 (blue) and Jurkat cells (green) using #4853.



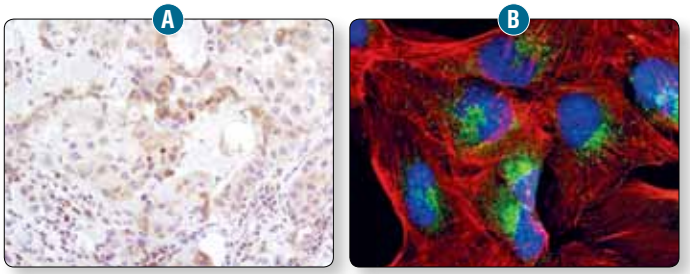
Selected Application References:

AIF Antibody #4642:
Pua, H.H. et al. (2009) *J. Immunol.* 182, 4046–4055. (W)
Gueven, N. et al. (2007) *Cell Death Differ.* 14, 1149–1161. (W)

Cytochrome C (136F3) Rabbit mAb #4280:
Widenmaier, S.B. et al (2009) *J. Biol. Chem.* 284, 30372–30382. (W)

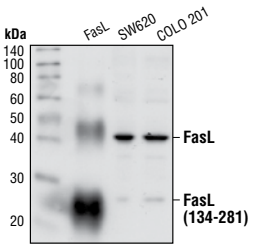
Smac/Diablo Mouse mAb #2954:
Gulmann, C. et al. (2005) *Clin. Cancer Res.* 11, 5847–5855. (W, IHC)

TNFR Family



TRAIL (C92B9) Rabbit mAb #3219: IHC analysis of paraffin-embedded human lung carcinoma **(A)** using #3219. Confocal IF analysis of 786-0 cells **(B)** using #3219 (green). Actin filaments were labeled with DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).

FasL Antibody #4273: WB analysis of recombinant human FasL (amino acids 134-281, 5 ng), and extracts from SW620 and COLO 201 cell lines using #4273.



		Applications	Reactivity
	#4756 DcR1 Antibody	W	H, M, R
	#4741 DcR2 Antibody	W	H
	#4758 DcR3 Antibody	W	H, M, R
	#3254 DR3 Antibody	W	H
	#3696 DR5 Antibody	W	H
	#4233 Fas (C18C12) Rabbit mAb	W, IHC-P	H
	#4273 FasL Antibody	W, IP, E-P	H
	#4845 RANK Antibody	W	H, M, R
	#4816 RANK Ligand (L300) Antibody	W, IP	H, M, (R, Mk, B, Pg)
	#3959 RANK Ligand (R2) Antibody	W, IP	H, (Mk, B, Pg)
	#3736 TNF-R1 (C25C1) Rabbit mAb	W, IP	H
	#3727 TNF-R2 Antibody	W, IP	H, M, R, (Mk)
	#3707 TNF-α Antibody	W, IP	H, M, (R, Mk, Pg)
	#3219 TRAIL (C92B9) Rabbit mAb	W, IP, IHC-P, IF-IC, F	H
NEW	**#4437 TWEAK Antibody**	W	H, (M, Mk)
	#4403 TWEAK Receptor/Fn14 Antibody	W, IP	H, M, R, B

Selected Application References:

TWEAK Receptor/Fn14 Antibody #4403:

Vince, J.E. et al. (2008) *J. Cell Biol.* 182, 171–184. (W)
Shan, W. et al. (2008) *Toxico.l Sci.* 105, 418–428. (W)
Dogra, C. et al. (2007) *J. Biol. Chem.* 282, 15000–15010. (W)

PhosphoPlus® Antibody Duets

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PhosphoPlus® Antibody Duets

#8223 PhosphoPlus® Bad (Ser112) Antibody Duet
Phospho-Bad (Ser112) (40A9) Rabbit mAb #5284 • Bad (D24A9) XP™ Rabbit mAb #9239

#8202 PhosphoPlus® Caspase-3 (Cleaved, Asp175) Antibody Duet
Cleaved Caspase-3 (Asp175) (5A1E) Rabbit mAb #9664 • Caspase-3 (8G10) Rabbit mAb #9665

#8219 PhosphoPlus® IκBα (Ser32/Ser36) Antibody Duet
Phospho-IκBα (Ser32/36) (5A5) Mouse mAb #9246 • IκBα (L35A5) Mouse mAb (Amino-terminal Antigen) #4814

#8214 PhosphoPlus® NF-κB p65/RelA (Ser536) Antibody Duet
Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb #3033 • NF-κB p65 (C22B4) Rabbit mAb #4764

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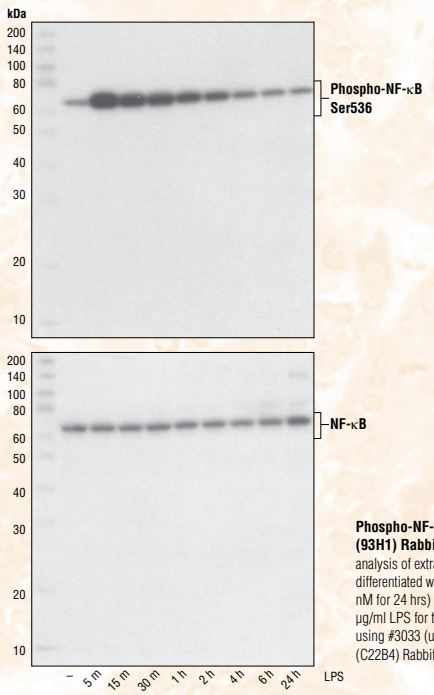

Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb #3033: WB analysis of extracts from THP-1 cells, differentiated with TPA #4174 (80 nM for 24 hrs) and treated with 1 µg/ml LPS for the indicated times, using #3033 (upper) and NF-κB p65 (C22B4) Rabbit mAb #4764 (lower).

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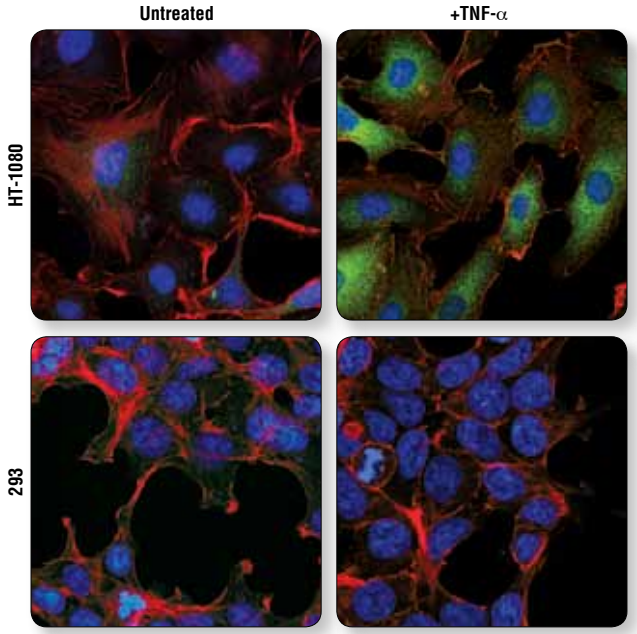
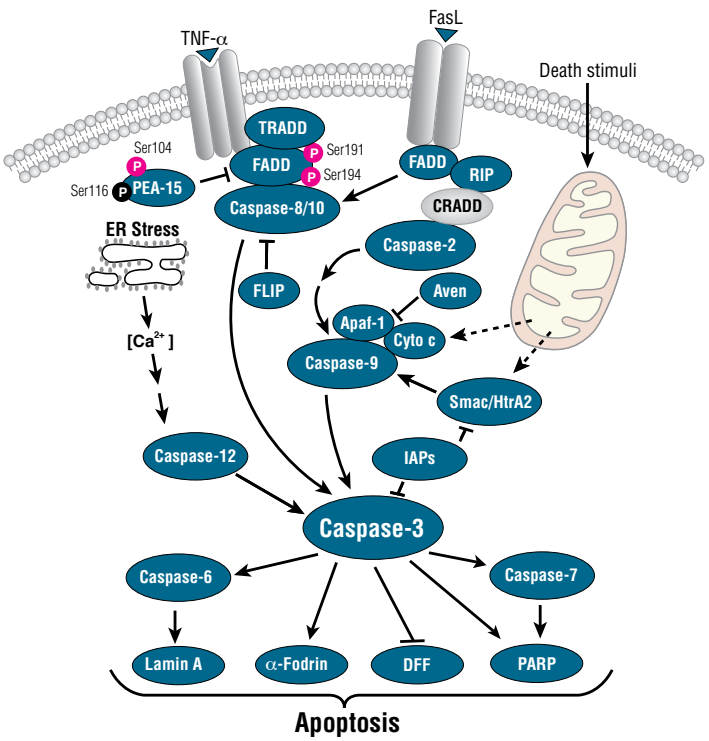
APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

Adaptor Proteins

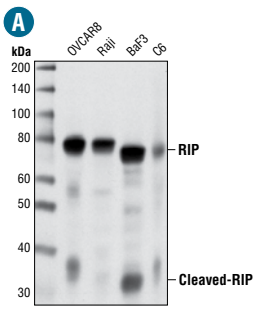
		Applications	Reactivity
NEW	#5630 A20/TNFAIP3 (D13H3) Rabbit mAb	W, IP	H, M, R, Mk
	#4625 A20/TNFAIP3 Antibody	W, IP	H, (Mk)
NEW	#5088 Apaf-1 (R205) Antibody	W, IP	H, (Mk)
	#2300 Aven Antibody	W, IF-IC, F	H, M, R, Mk
	#4237 Bcl10 (C78F1) Rabbit mAb	W, IP	H, M, R, (Mk)
	#4880 Phospho-DBC1 (Thr454) Antibody	W, IP, IF-IC	H
	#2785 Phospho-FADD (Ser191) Antibody (Mouse Specific)	W	M
	#2781 Phospho-FADD (Ser194) Antibody (Human Specific)	W	H
	#2782 FADD Antibody (Human Specific)	W	H
	#4932 FAF1 Antibody	W	H, M, R
	#3210 FLIP Antibody	W	H, M, R, Mk
	#2494 MALT1 Antibody	W, IP	H, M, R
	#4990 NALP1 Antibody	W	H, M, R, (Mk)
	#3545 Nod1 Antibody	W	H, M, R, Mk
	#2776 Phospho-PEA-15 (Ser104) Antibody	W, IP	H, R, (M)
	#2780 PEA-15 Antibody	W, IP	H, M, R, Mk
	#3493 RIP (D94C12) XP™ Rabbit mAb	W, IP, IF-IC	H, M, R, Hm, Mk
	#4926 RIP Antibody	W	H, Mk
	#4982 RIP2 Antibody	W	H, M, Mk, R
	#2141 TANK Antibody	W, IP	H, M, R, (Mk, B, Dg)
	#3684 TRADD (7G8) Rabbit mAb	W, IP	H
	#3694 TRADD Antibody	W, IP, F	H, M, R, Mk
	#4715 TRAF1 (45D3) Rabbit mAb	W, IP, IHC-P, IF-IC, F	H, (Mk)
	#4710 TRAF1 (1F3) Rat mAb	W, IP, IHC-P, IF-IC	H, M, R
	#4724 TRAF2 (C192) Antibody	W, IP, IF-IC	H, M, Mk
	#4712 TRAF2 Antibody	W	H, M, R, Mk
	#4729 TRAF3 Antibody	W	H, M, R, Mk
	#4743 TRAF6 Antibody	W, IP	H

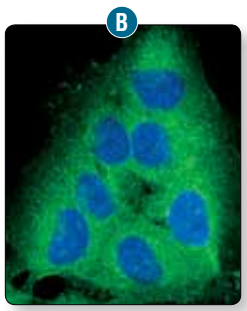


TRAF1 (45D3) Rabbit mAb #4715: Confocal IF analysis of HT-1080 (upper) and 293 cells (lower), untreated (left) or treated with hTNF-α #8902 (right), using #4715 (green). Actin filaments were labeled with DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).



RIP (D94C12) XP™ Rabbit mAb #3493: WB analysis of extracts from various cell lines **(A)** using #3493. Confocal IF analysis of OVCAR8 cells **(B)** using #3493 (green). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).





Selected Application References:

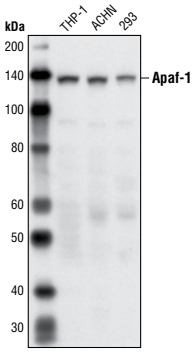
Phospho-FADD (Ser194) Antibody (Human Specific) #2781:
Chen, G. et al. (2005) *Proc. Natl. Acad. Sci. USA* 102, 12507–12512. (W)
Shimada, K. et al. (2004) *Carcinogenesis* 25, 1089–1097. (W)

FADD Antibody (Human Specific) #2782:
Uriarte, S.M. et al. (2005) *Cell Death Differ.* 12, 233–242. (W)
Kim, S.H. et al. (2004) *J. Biol. Chem.* 279, 40044–40052. (W)

FLIP Antibody #3210:
Jin, Z. et al. (2004) *J. Biol. Chem.* 279, 35829–35839. (W)

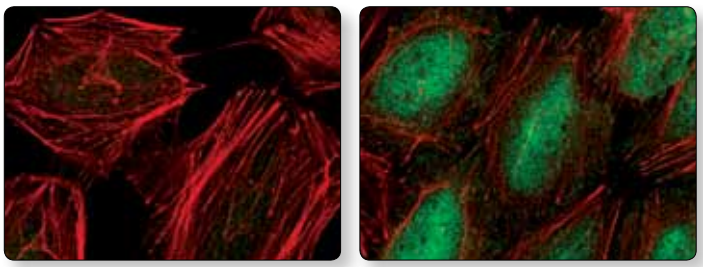
RIP2 Antibody #4982:
Rosenstiel, P. et al. (2006) *Proc. Natl. Acad. Sci. USA* 103, 3280–3285. (W)

TANK Antibody #2141:
Kawagoe, T. et al. (2009) *Nat. Immunol.* 10, 965–972. (W)

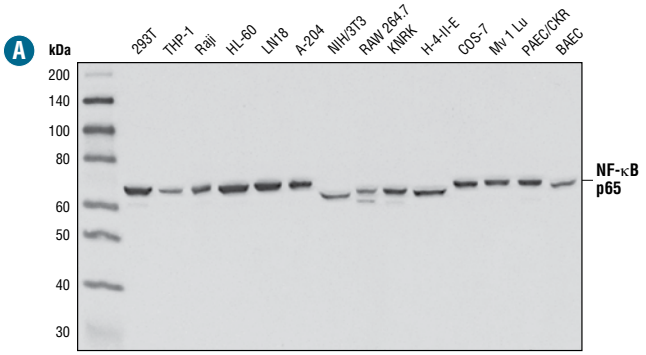


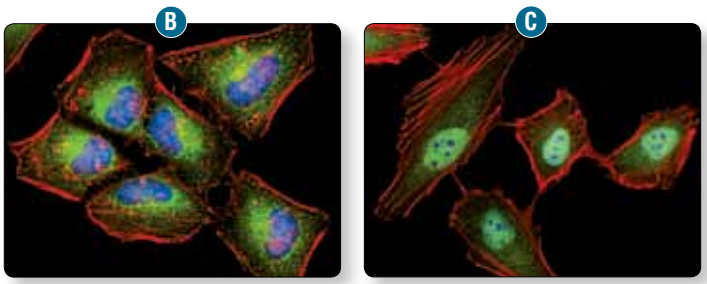
Apaf-1 (R205) Antibody #5088: WB analysis of extracts from THP-1, ACHN, and 293 cells using #5088.

NF-κB and IκB Family Proteins



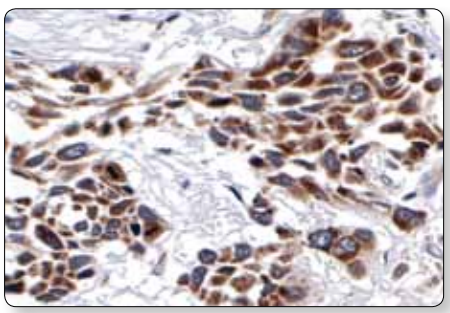
Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb #3033: Confocal IF analysis of HeLa cells, untreated (left) or treated with hTNF-α #8902 (20 ng/ml, 20 min.; right), using #3033 (green). Actin filaments were labeled with Alexa Fluor® phalloidin 555 (red).





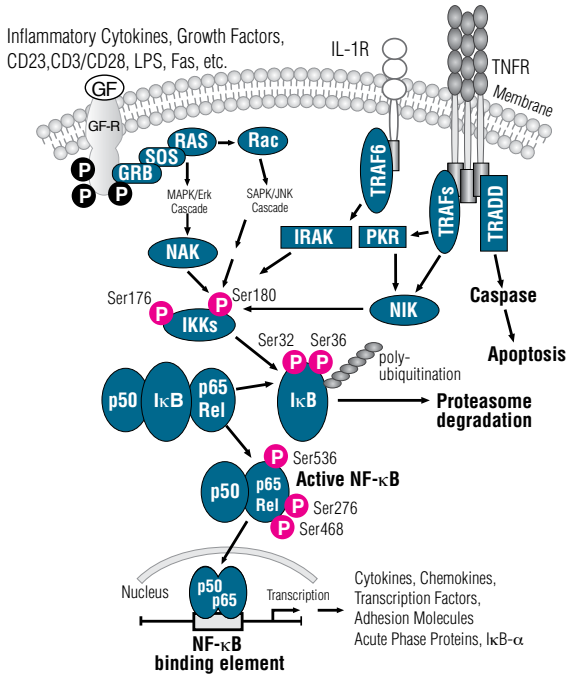
NF-κB p65 (E498) Antibody #3987: WB analysis of extracts from various cell lines **(A)** using #3987. Confocal IF analysis of HeLa cells, untreated **(B)** or treated with hTNF-α #8902 (20 ng/ml, 20 min.) **(C),** using #3987 (green). Actin filaments were labeled with DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).

NF-κB2 p100/p52 (18D10) Rabbit mAb (Human Specific) #3017: IHC analysis of paraffin-embedded human lung carcinoma using #3017.



			Applications	Reactivity
	#2859	Phospho-IκBα (Ser32) (14D4) Rabbit mAb	W, IP	H, M, R, Mk, (Pg)
	#9246	Phospho-IκBα (Ser32/36) (5A5) Mouse mAb	W, IP, IHC-P	H, M, R, Mk, Dg, (B, Pg)
NEW	#4088	Phospho-IκBα (Ser32/36) (5A5) Mouse mAb (Sepharose Bead Conjugate)	IP	H, M, R, Mk, Dg, (B, Pg)
	#5210	Phospho-IκBα (Ser32/36) (12C2) Mouse mAb	ELISA	H, M, R
	#4812	IκBα (44D4) Rabbit mAb	W, IP	H, M, R, Hm, Mk, Mi
	#9242	IκBα Antibody	W, IP	H, M, R, Mk, B, Dg, Pg
	#4814	IκBα (L35A5) Mouse mAb (Amino-terminal Antigen)	W, IP, IHC-P, IF-IC, F	H, M, R, Mk, B, Pg
NEW	#4078	IκBα (L35A5) Mouse mAb (Amino-terminal Antigen) (Sepharose Bead Conjugate)	IP	H, M, R, Mk, B, Pg
	#9247	IκBα (112B2) Mouse mAb (Carboxy-terminal Antigen)	W, IP	H, M, R, Mk
	#4921	Phospho-IκBβ (Thr19/Ser23) Antibody (Human Specific)	W	H, (Mk, Dg)
	#9245	Phospho-IκBβ (Ser19/23) Antibody (Mouse/Rat Specific)	W	M, R
	#9248	IκBβ Antibody	W	H, M, R, Mk
	#4924	Phospho-IκBε (Ser18/22) Antibody	W	H, M, R, (B, Dg)
	#9249	IκBε Antibody	W	H, M, R, Mk
NEW	#9244	IκB-ζ Antibody	W, IP	H
	#3045	Acetyl-NF-κB p65 (Lys310) Antibody	W, IP	H, M, (R, Mk, B, Dg)
	#3037	Phospho-NF-κB p65 (Ser276) Antibody	W, IHC-P	H, M, R, (B, Dg, Pg)
	#3039	Phospho-NF-κB p65 (Ser468) Antibody	W	H, M, R
	#3033	Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb	W, IP, IF-IC, F	H, M, R, Hm, Mk, Pg, (Dg)
	#4886	Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb (Alexa Fluor® 488 Conjugate)	F	H, M, R, Hm, Mk, Pg, (Dg)
	#4887	Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb (Alexa Fluor® 647 Conjugate)	F	H, M, R, Hm, Mk, Pg, (Dg)
	#3031	Phospho-NF-κB p65 (Ser536) Antibody	W	H, M, R, Mk, (Dg, Pg)
	#3036	Phospho-NF-κB p65 (Ser536) (7F1) Mouse mAb	W	H, M, R, Mk, Mi, (Dg)
	#4764	NF-κB p65 (C22B4) Rabbit mAb	W, IHC-P, IF-IC, F	H, M, R, Mk, B, (Dg)
NEW	#3987	NF-κB p65 (E498) Antibody	W, IP, IHC-P, IF-IC, F	H, M, R, Hm, Mk, Mi, B, Dg, Pg
	#3034	NF-κB p65 Antibody	W, IP	H, M, R, Hm, Mk, Mi, (Dg)
	#4810	Phospho-NF-κB2 p100 (Ser866/870) Antibody	W, IP	H, M, (R, B, Dg)
	#3017	NF-κB2 p100/p52 (18D10) Rabbit mAb (Human Specific)	W, IHC-P, F	H, Mk
	#4882	NF-κB2 p100/p52 Antibody	W, IP	H, M, R, Mk
	#4806	Phospho-NF-κB p105 (Ser933) (18E6) Rabbit mAb	W, IP	H, M, R, Mk
	#4808	Phospho-NF-κB p105 (Ser933) (178F3) Rabbit mAb (IHC Specific)	IHC-P	H
	#4717	NF-κB1 p105 Antibody	W, IP	H, M, R, Mk, Mi, B, Pg
	#3035	NF-κB1 p105/p50 Antibody	W, IP, ChIP	H, Mk
	#9777	Pirin (1E8) Rat mAb	W, IP, F	H, M, R, Hm, Mk, B
NEW	#5025	Phospho-RelB (Ser552) (D41B9) XP™ Rabbit mAb	W, IP, IF-IC, F	H, M, (R, Mk, B, Dg)
NEW	#4999	Phospho-RelB (Ser552) Antibody	W, IP, IF-IC, F	H, M, (R, Mk, B, Dg)
	#4922	RelB (C1E4) Rabbit mAb	W, IP	H, M, R, Mk
	#4954	RelB Antibody	W, IP	H, M, R, Mk
NEW	#4774	c-Rel (G57) Antibody	W	H, M, R, (Mk, Dg)
	#4727	c-Rel Antibody	W, IP, IHC-P, IF-IC, F	H, Mk

APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA



Selected Application References:

Phospho-IκBα (Ser32/36) (5A5) Mouse mAb #9246: Saitoh, Y. et al. (2008) *Blood* 111, 5118–5129. (W) / Luedde, T. et al. (2008) *Proc. Natl. Acad. Sci. USA* 105, 9733–9738. (W) / Vince, J.E. et al. (2008) *J. Cell Biol.* 182, 171–184. (W) / Mabilleau, G. and Sabokbar, A. (2009) *PLoS ONE* 4, e4173. (W) / Tokunaga, F. et al. (2009) *Nat. Cell Biol.* 11, 123–132. (W) / Chiron, D. et al. (2009) *J. Immunol.* 182, 4471–4478. (W) / Turner, N.A. et al. (2009) *Am. J. Physiol. Heart Circ. Physiol.* 297, 1117–1127. (W)

IκBα (L35A5) Mouse mAb (Amino-terminal Antigen) #4814: Cui, W. et al. (2007) *Proc. Natl. Acad. Sci. USA* 104, 14436–14441. (W) / Shimada, M. et al. (2008) *Development* 135, 2001–2011. (W) / Harrison, L.M. et al. (2008) *Infect. Immun.* 76, 5524–5534. (W) / Mabilleau, G. and Sabokbar, A. (2009) *PLoS ONE* 4, e4173. (W)

Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb #3033: Lacasa, D. et al. (2007) *Endocrinology* 148, 868–877. (W) / Suzuki, S. et al. (2007) *J. Biol. Chem.* 282, 25177–25181. (W) / Lou, H. and Kaplowitz, N. (2007) *J. Biol. Chem.* 282, 29470–29481. (W) / Peiser, M. et al. (2008) *J. Leukoc. Biol.* 83, 1118–1127. (ELISA) / Luedde, T. et al. (2008) *Proc. Natl. Acad. Sci. USA* 105, 9733–9738. (W) / Vince, J.E. et al. (2008) *J. Cell Biol.* 182, 171–184. (W) / Yadav, U.C. et al. (2009) *Invest. Ophthalmol. Vis. Sci.* 50, 2276–2282. (IF) / Dai, P. et al. (2009) *J. Immunol.* 182, 3450–3460. (W) / Milsom, M.D. et al. (2009) *Blood* 113, 5111–5120. (W) / Liu, M. et al. (2009) *Am. J. Pathol.* 174, 1910–1920. (W) / Yamanaka, Y. et al. (2009) *Blood* 114, 3265–3275. (W) / Solt, L.A. et al. (2009) *J. Biol. Chem.* 284, 27596–27608. (W) / Wang, H. et al. (2009) *J. Immunol.* 183, 4755–4763. (IHC) / Xie, S. et al. (2010) *J. Immunol.* 184, 2289–2296. (W, IF, IHC)

NF-κB p65 (C22B4) Rabbit mAb #4764: Hasler, U. et al. (2008) *J. Biol. Chem.* 283, 28095–28105. (W) / Hideshima, T. et al. (2009) *Blood* 113, 5228–5236. (W, IHC) / Xie, S. et al. (2010) *J Immunol.* 184, 2289–2296. (W)

NF-κB p65 Antibody #3034: Minami, M. et al. (2008) *J. Biol. Chem.* 283, 9692–9703. (W)

Unparalleled Product Quality, Validation, and Technical Support

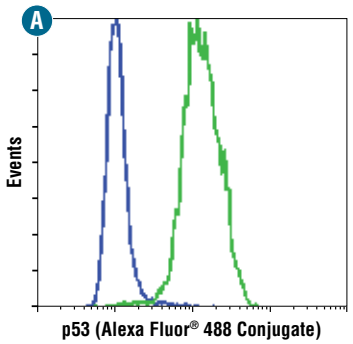
NF-κB Antibody Comparison

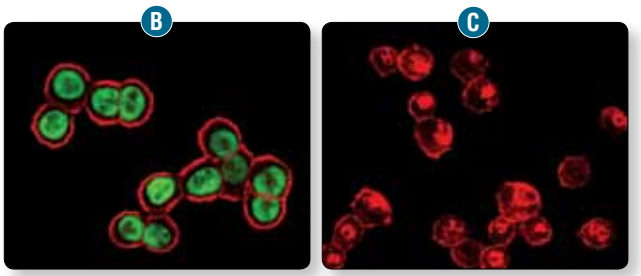
	Reactivity	WB	IP	IHC	Flow	IF
#3045 Acetyl-NF-κB p65 (Lys310) Antibody	H, M, (R, Mk, B, Dg)	+++	+++	N/T	N/T	N/T
#3037 Phospho-NF-κB p65 (Ser276) Antibody	H, M, R, (B, Dg, Pg)	++	-	+++	N/T	N/T
#3039 Phospho-NF-κB p65 (Ser468) Antibody	H, M, R	+++	N/T	N/T	N/T	N/T
#3033 Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb	H, M, R, Hm, Mk, Pg, (Dg)	++++	++++	-	+++	++
#4886 Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb (Alexa Fluor® 488 Conjugate)	H, M, R, Hm, Mk, Pg, (Dg)	N/A	N/A	N/A	+++	-
#4887 Phospho-NF-κB p65 (Ser536) (93H1) Rabbit mAb (Alexa Fluor® 647 Conjugate)	H, M, R, Hm, Mk, Pg, (Dg)	N/A	N/A	N/A	+++	-
#3031 Phospho-NF-κB p65 (Ser536) Antibody	H, M, R, Mk, (Dg, Pg)	++	-	N/T	N/T	N/T
#3036 Phospho-NF-κB p65 (Ser536) (7F1) Mouse mAb	H, M, R, Mk, Mi, (Dg)	++	-	-	-	-
#4764 NF-κB p65 (C22B4) Rabbit mAb	H, M, R, Mk, B, (Dg)	+++	-	++	++	+++
#3034 NF-κB p65 Antibody	H, M, R, Hm, Mk, Mi, (Dg)	++	++	N/T	-	-
#3987 NF-κB p65 (E498) Antibody	H, M, R, Hm, Mk, Mi, B, Dg, Pg	++++	++++	++++	++++	++++
#4810 Phospho-NF-κB2 p100 (Ser866/870) Antibody	H, M, (R, B, Dg)	+++	+++	N/T	N/T	N/T
#3017 NF-κB2 p100/p52 (18D10) Rabbit mAb (Human Specific)	H, Mk	+++	N/T	+++	+++	N/T
#4882 NF-κB2 p100/p52 Antibody	H, M, R, Mk	+++	+++	N/T	N/T	N/T
#4806 Phospho-NF-κB p105 (Ser933) (18E6) Rabbit mAb	H, M, R, Mk	+++	+++	-	N/T	N/T
#4808 Phospho-NF-κB p105 (Ser933) (178F3) Rabbit mAb (IHC Specific)	H	-	N/T	+++	N/T	N/T
#4717 NF-κB1 p105 Antibody	H, M, R, Mk, Mi, B, Pg	+++	+++	-	-	-
#3035 NF-κB1 p105/p50 Antibody	H, Mk	+++	+++	-	-	-
#4774 c-Rel (G57) Antibody	H, M, R, (Mk, Dg)	++	-	-	N/T	N/T
#4727 c-Rel Antibody	H, Mk	++++	+++	+++	+++	+++
#5025 Phospho-RelB (Ser552) (D41B9) XP™ Rabbit mAb	H, M, (R, Mk, B, Dg)	+++	+++	N/T	+++	+++
#4999 Phospho-RelB (Ser552) Antibody	H, M, (R, Mk, B, Dg)	++	++	N/T	++	++
#4922 RelB (C1E4) Rabbit mAb	H, M, R, Mk	+++	+++	-	-	-
#4954 RelB Antibody	H, M, R, Mk	+++	+++	-	-	-

Testing Key: ++++ Very Highly Recommended / +++ Highly Recommended / ++ Recommended / – Not Recommended / N/T Not Tested / N/A Not Applicable

p53

p53 (7F5) Rabbit mAb (Alexa Fluor® 488 Conjugate) #5429: Flow cytometric analysis of K562 (blue) and HT-29 cells (green) using #5429 **(A)**. Confocal IF analysis of HT-29 cells (positive) **(B)** and THP-1 cells (negative) **(C)** using #5429 (green). Actin filaments were labeled with DY-554 phalloidin (red).





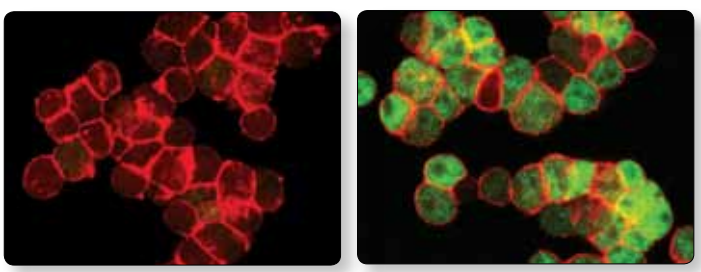
			Applications	Reactivity
	#2570	Acetyl-p53 (Lys379) Antibody	W	H, M
	#2525	Acetyl-p53 (Lys382) Antibody	W	H
	#9285	Phospho-p53 (Ser6) Antibody	W, IP, IC	H, M, Mk, (Hm)
	#9288	Phospho-p53 (Ser9) Antibody	W, IP	H, Mk
	#9284	Phospho-p53 (Ser15) Antibody	W, IP, IF-IC	H, M, R, Mk
	#9286	Phospho-p53 (Ser15) (16G8) Mouse mAb	W, IF-IC, F	H
	#9235	Phospho-p53 (Ser15) (16G8) Mouse mAb (Alexa Fluor® 488 Conjugate)	IF-IC, F	H
NEW	#4030	Phospho-p53 (Ser15) (16G8) Mouse mAb (Biotinylated)	W, F	H
	#2529	Phospho-p53 (Thr18) Antibody	W	H
	#9287	Phospho-p53 (Ser20) Antibody	W	H, M, Mk
	#2526	Phospho-p53 (Ser33) Antibody	W, IHC-P	H, (Mk)
	#9289	Phospho-p53 (Ser37) Antibody	W, IP, IF-IC, F	H, Mk
	#2521	Phospho-p53 (Ser46) Antibody	W, IP, IF-IC, F	H, Mk
	#2676	Phospho-p53 (Thr81) Antibody	W, IHC-P, IF-IC	H, Mk
	#2528	Phospho-p53 (Ser315) Antibody	W	H, (Mk, B)
	#9281	Phospho-p53 (Ser392) Antibody	W	H, M
	#2527	p53 (7F5) Rabbit mAb	W, IHC-P, IF-IC, F	H, Mk
NEW	#5429	p53 (7F5) Rabbit mAb (Alexa Fluor® 488 Conjugate)	IF-IC, IF-P, F	H, Mk
NEW	#5395	p53 (7F5) Rabbit mAb (Alexa Fluor® 555 Conjugate)	IF-IC	H, Mk
NEW	#4667	p53 (7F5) Rabbit mAb (Biotinylated)	W, F	H, Mk
	#9282	p53 Antibody	W, IP	H, R, Mk
	#2524	p53 (1C12) Mouse mAb	W, IP, IF-IC	H, M, R, Mk
	#2015	p53 (1C12) Mouse mAb (Alexa Fluor® 488 Conjugate)	IF-IC, F	H, M, R, Mk
	#2533	p53 (1C12) Mouse mAb (Alexa Fluor® 647 Conjugate)	IF-IC, F	H, M, R, Mk

Other Transcriptional Regulators

			Applications	Reactivity
	#3215	AP-2α (C83E10) Rabbit mAb	W, IF-IC	H, M, R, Mk
	#3208	AP-2α Antibody	W, IP, IHC-P	H, M, R, Mk
	#2509	AP-2β Antibody	W, IP, IF-IC	H, M, R
	#2320	AP-2γ Antibody	W, IF-IC	H
	#3605	DIDO1 Antibody	W	H, M, R, (Mk)
	#4682	Mad-1 Antibody	W	H, M, R
	#4739	Max (S20) Antibody	W, IF-IC	H, M, R, (Mk, B)
	#5605	c-Myc (D84C12) XP™ Rabbit mAb	W, IP, IF-IC, F	H, M, R, (Mk, Dg, Pg)
	#9402	c-Myc Antibody	W, IP, ChIP	H, M, R, Pg
	#9405	N-Myc Antibody	W	H
NEW	#5095	Phospho-Nur77 (Ser351) (D22G5) Rabbit mAb	W	H, (M, R)
	#3960	Nur77 (D63C5) XP™ Rabbit mAb	W, IP, IF-IC, F	H, (Mk)
	#3559	Nur77 (P15) Antibody	W, IP	H
	#2329	Phospho-PAR-4 (Thr163) Antibody	W	H, (M, R, Mk)
	#2328	PAR-4 Antibody	W, IP, IF-IC, F	H, M, R, Mk
	#5844	RMP Antibody	W, IP	H, M, R, Mk
	#2185	YY1 (13G10) Rabbit mAb	W, IP	H, M, R

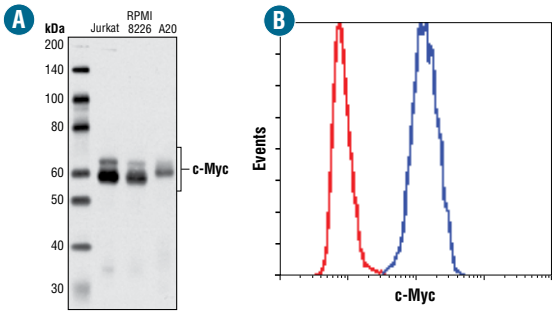
Selected Application References:

Phospho-c-Myc (Thr58/Ser62) Antibody #9401:
Watnick, R.S. et al. (2003) *Cancer Cell* 3, 219–231. (W) / Kamemura, K. et al. (2002) *J. Biol. Chem.* 21, 19229–19235. (W) / Sears, R. et al. (2000) *Genes Dev.* 14, 2501–2514. (W) / Noguchi, K. et al. (1999) *J. Biol. Chem.* 274, 32580–32587. (W) / Sun, Y. and Clark, E.A. (1999) *J. Exp. Med.* 189, 1391–1398. (W)



Nur77 (D63C5) XP™ Rabbit mAb #3960: Confocal IF analysis of Jurkat cells, untreated (left) or treated with TPA #4174 and A23187 (right), using #3960 (green). Actin filaments were labeled with DY-554 Phalloidin (red).

c-Myc (D84C12) XP™ Rabbit mAb #5605: WB analysis of extracts from various cell lines using #5605 **(A)**. Flow cytometric analysis of Raji cells using #5605 (blue) compared to a nonspecific negative control antibody (red) **(B)**.

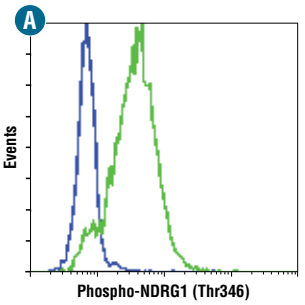


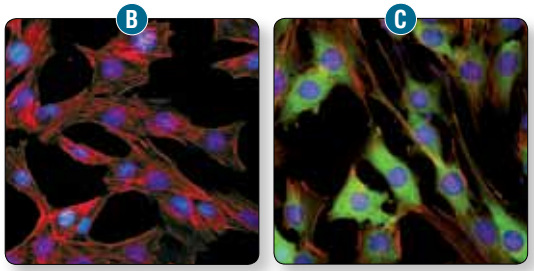
APPLICATIONS KEY:
W Western / **IP** Immunoprecipitation / **IHC** Immunohistochemistry / **IF** Immunofluorescence / **F** Flow Cytometry / **ChIP** Chromatin Immunoprecipitation / (**-IC** Immunocytochemistry, **-P** Paraffin, **-F** Frozen) / **E-P** Peptide ELISA

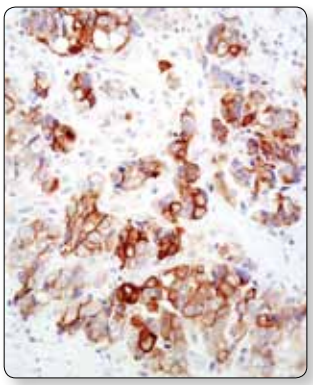
Other Signaling Proteins

		Applications	Reactivity
	#2171 Alix (3A9) Mouse mAb	W, IP	H, M, R, Mk
	#4043 BAP31 Antibody	W, IP	H, M, R, Mk, (B, Dg)
	#2282 DAP1 Antibody	W, IP	H, M, R
	#2182 DAP5 Antibody	W	H, M, R
	#3008 DAPK1 Antibody	W	H, M, R, (Mk)
	#2928 DAPK3/ZIPK Antibody	W	H, M, R, (Mk)
	#4533 Daxx (25C12) Rabbit mAb	W, IF-IC	H, M, R, (Mk, B, Dg)
NEW	**#5693 DBC1 Antibody**	W, IP	H, M, R, Mk
	#2294 DRAK2 (33D7) Rabbit mAb	W, IP, IHC-P, F	M
NEW	**#5672 DYRK1B (D40D1) Rabbit mAb**	W, IP	H, M, R, (Mk)
NEW	**#5091 HIPK2 Antibody**	W	H, M, R
NEW	**#5418 LGALS1 Antibody**	W	H, M, R, (Mk)
	#9119 Maspin (L250) Antibody	W	H, (Mk)
	#9117 Maspin (T50) Antibody	W, IP	H, M, R, (Mk)
	#3506 Phospho-NDRG1 (Ser330) Antibody	W, IP	H, M, (R, Mk)
NEW	**#5482 Phospho-NDRG1 (Thr346) (D98G11) XP™ Rabbit mAb**	W, IHC-P, IF-IC, F	H, M, R, Mk
	#3217 Phospho-NDRG1 (Thr346) Antibody	W, IP	H, M, R, (Mk)
NEW	**#5196 NDRG1 Antibody**	W, IP, IHC-P	H, M, R, Mk
NEW	**#5846 NDRG3 Antibody**	W, IP	H, M, R, Mk
	#3187 NQO1 (A180) Mouse mAb	W, IHC-P, IF-IC	H
	#9535 PDCD4 (D29C6) XP™ Rabbit mAb	W, IP, IHC-P, IF-IC	H, M, R
NEW	**#4294 PHLDA3 Antibody**	W	H, M, R, Mk
	#3247 Pim-1 (C93F2) Rabbit mAb	W	H, M, (R, Mk, B)
	#2907 Pim-1 Antibody	W	H, (Mk)
	#4730 Pim-2 (D1D2) XP™ Rabbit mAb	W, IP, IHC-P, IF-IC	H
	#4165 Pim-3 (D17C9) Rabbit mAb	W, IP	H, M, R, (Mk)
	#3751 Phospho-SHP-2 (Tyr542) Antibody	W, IP	H, M, R, (Mk, C, X)
NEW	**#5431 Phospho-SHP-2 (Tyr580) (D66F10) Rabbit mAb**	W, IP, F	M, R, (H)
	#3703 Phospho-SHP-2 (Tyr580) Antibody	W, IP	H, M, R, (C)
	#3397 SHP-2 (D50F2) Rabbit mAb	W, IP	H, M, R, Mk
	#3752 SHP-2 Antibody	W	H, M, R
	#3867 nSMase1 Antibody	W	H, Mk
NEW	**#4307 Thymidine Phosphorylase/ECGF1 (D69B12) Rabbit mAb**	W, IP	H
	#2937 TP/ECGF1 Antibody	W	H
	#4628 TMS1 Antibody	W	H, M, (R, Mk)
	#4045 WWOX Antibody	W	H, M, R, (Mk)
	#9807 Paclitaxel		
	#9953 Staurosporine		

Phospho-NDRG1 (Thr346) (D98G11) XP™ Rabbit mAb #5482: Flow cytometric analysis of Jurkat cells **(A)**, untreated (green) or treated with LY294002 #9901, Wortmannin #9951, and U0126 #9903 (blue), using #5482. Confocal IF analysis of C2C12 cells, treated with LY294002 #9901 **(B)** or insulin **(C)**, using #5482 (green). Actin filaments were labeled with DY-554 phalloidin (red). Blue pseudocolor = DRAQ5® #4084 (fluorescent DNA dye).





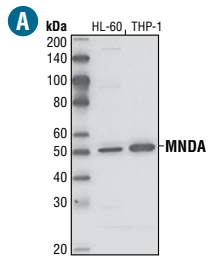


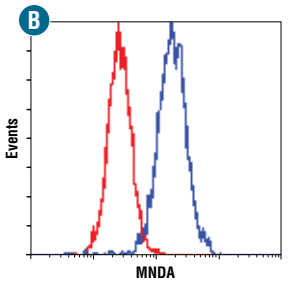
NDRG1 Antibody #5196: IHC analysis of paraffin-embedded human colon carcinoma using #5196.

Granzymes and Other Proteases

		Applications	Reactivity
	#2284 Cathepsin D Antibody	W, IHC-P, F	H, Mk
	#4928 Granzyme A Antibody	W, E-P	H
	#4275 Granzyme B Antibody	W, E-P	H, M, R
NEW	**#3329 MNDA (3C1) Rat mAb**	W, F	H
	#3693 Perforin Antibody (Mouse Specific)	W, IF-IC, F	M

MNDA (3C1) Rat mAb #3329: WB analysis of extracts from HL-60 and THP-1 cells **(A)** using #3329. Flow cytometric analysis of Jurkat cells (red) and THP-1 cells (blue) **(B)** using #3329.





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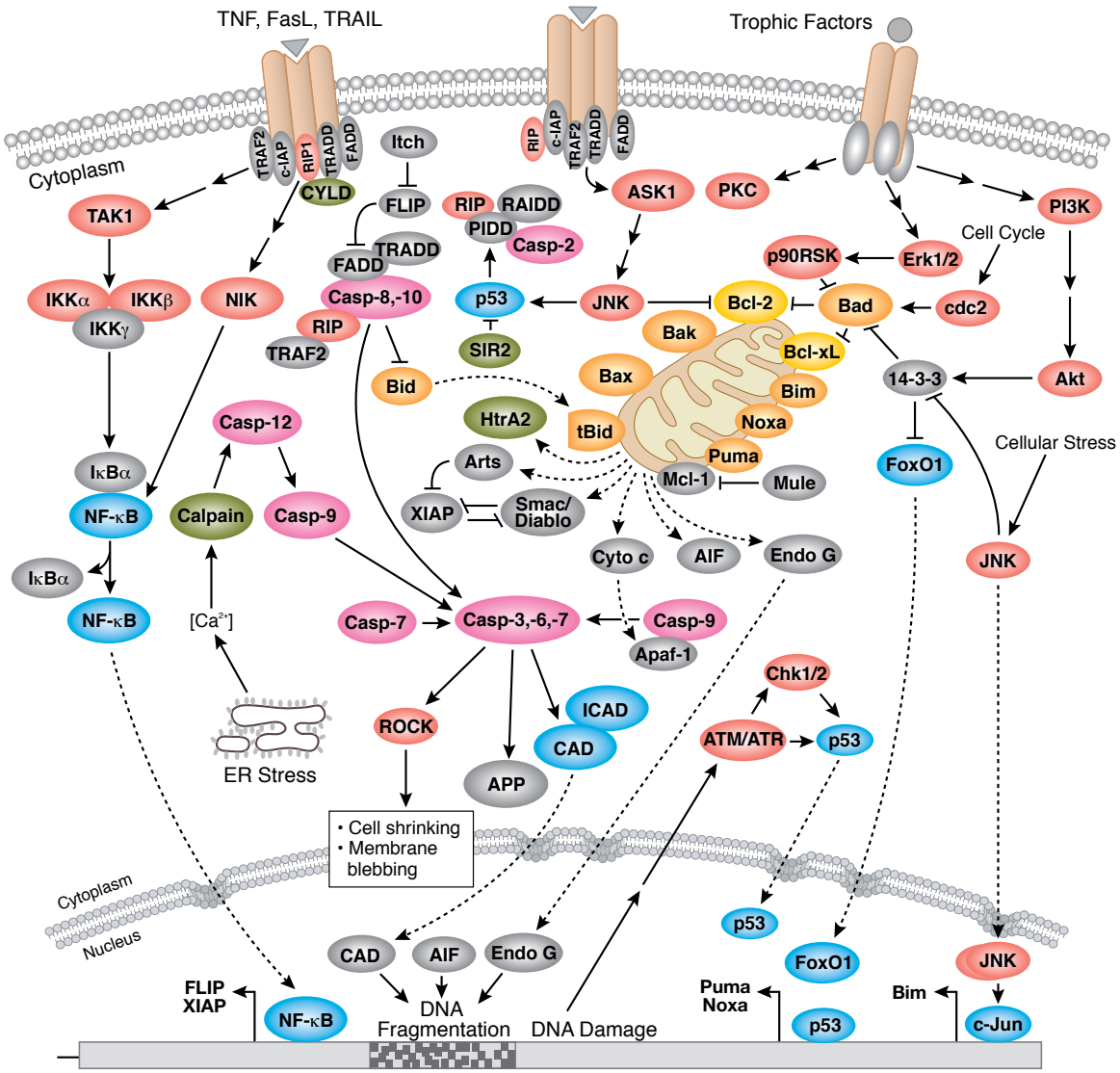
Signaling Pathways

Apoptosis Overview



Pathway Description: Apoptosis is a regulated cellular suicide mechanism characterized by nuclear condensation, cell shrinkage, membrane blebbing, and DNA fragmentation. Caspases, a family of cysteine proteases, are the central regulators of apoptosis. Initiator caspases (including caspase-2, -8, -9, -10, -11, and -12) are closely coupled to pro-apoptotic signals. Once activated, these caspases cleave and activate downstream effector caspases (including caspase-3, -6, and -7), which in turn execute apoptosis by cleaving cellular proteins following specific Asp residues. Activation of Fas and TNFR by FasL and TNF, respectively, leads to the activation of caspase-8 and -10. DNA damage induces the expression of PIDD which binds to RAIDD and caspase-2 and leads to the activation of caspase-2. Cytochrome c released from damaged mitochondria is coupled to the activation of caspase-9. XIAP inhibits caspase-3, -7, and -9. Mitochondria release multiple pro-apoptotic molecules, such as Smac/Diablo, AIF, HtrA2 and EndoG, in addition to cytochrome c. Smac/Diablo binds to XIAP which prevents it from inhibiting caspases. Caspase-11 is induced and activated by pathological proinflammatory and pro-apoptotic stimuli and leads to the activation of caspase-1 to promote inflammatory response and apoptosis by directly processing caspase-3. Caspase-12 and caspase-7 are activated under ER stress conditions. Anti-apoptotic ligands including growth factors and cytokines activate Akt and p90RSK. Akt inhibits Bad by direct phosphorylation and prevents the expression of Bim by phosphorylating and inhibiting the Forkhead family of transcription factors (Fox0). Fox0 promotes apoptosis by upregulating pro-apoptotic molecules such as FasL and Bim.

Selected Reviews:

Degterev, A. and Yuan, J. (2008) Expansion and evolution of cell death programmes. *Nat. Rev. Mol. Cell Biol.* 9, 378–390.

Kurokawa, M. and Kornbluth, S. (2009) Caspases and kinases in a death grip. *Cell* 138, 838–854.

Meulmeester, E. and Jochemsen, A.G. (2008) p53: a guide to apoptosis. *Curr. Cancer Drug Targets* 8, 87–97.

Pradelli, L.A. et al. (2010) Mitochondrial control of caspase-dependent and -independent cell death. *Cell. Mol. Life Sci.* 67, 1589–1597.

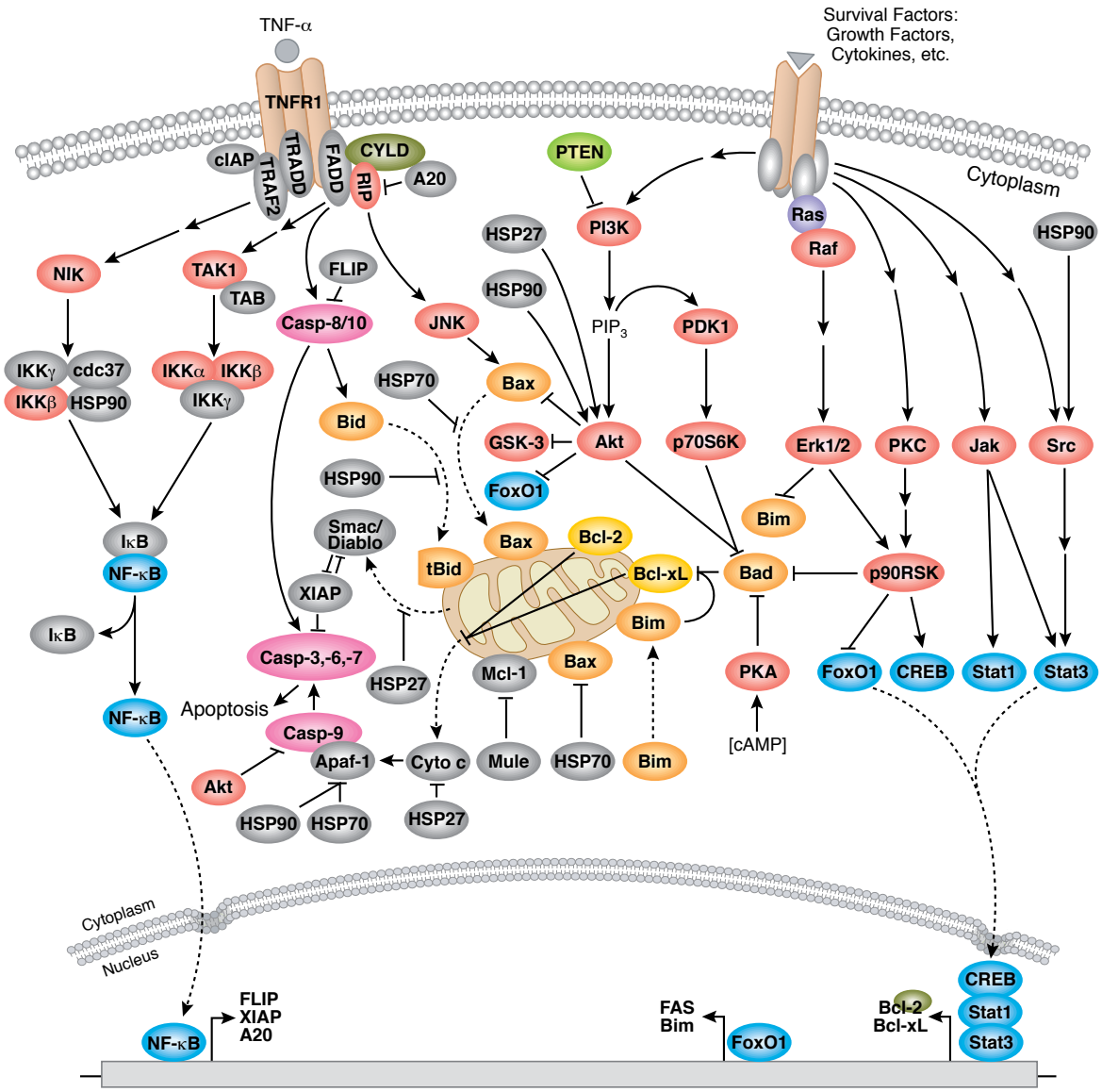
Salvesen, G.S. and Riedl, S.J. (2008) Caspase mechanisms. *Adv. Exp. Med. Biol.* 615, 13–23.

Taylor, R.C. et al. (2008) Apoptosis: controlled demolition at the cellular level. *Nat. Rev. Mol. Cell Biol.* 9, 231–241.

Van Herreweghe, F. et al. (2010) Tumor necrosis factor-mediated cell death: to break or to burst, that's the question. *Cell. Mol. Life Sci.* 67, 1567–1579.

Direct Stimulatory Modification
Direct Inhibitory Modification
Multistep Stimulatory Modification
Multistep Inhibitory Modification
Tentative Stimulatory Modification
Tentative Inhibitory Modification
Transcriptional Stimulatory Modification
Transcriptional Inhibitory Modification

Inhibition of Apoptosis



Pathway Description: Cell survival requires the active inhibition of apoptosis, which is accomplished by inhibiting the expression of pro-apoptotic factors as well as promoting the expression of anti-apoptotic factors. The PI3K pathway, activated by many survival factors, leads to the activation of Akt, an important player in survival signaling. PTEN negatively regulates the PI3K/Akt pathway. Activated Akt inhibits the pro-apoptotic Bcl-2 family member Bad, Bax, caspase-9, GSK-3 and FoxO1 by phosphorylation. Many growth factors and cytokines induce anti-apoptotic Bcl-2 family members. The Jaks and Src phosphorylate and activate Stat3, which in turn induces the expression of Bcl-xL and Bcl-2. Erk1/2 and PKC activate p90RSK, which activates CREB and induces the expression of Bcl-xL and Bcl-2. These Bcl-2 family members protect the integrity of mitochondria, preventing cytochrome c release and the subsequent activation of caspase-9. TNF-α may activate both pro-apoptotic and anti-apoptotic pathways; TNF-α can induce apoptosis by activating caspase-8 and -10, but can also inhibit apoptosis signaling via NF-κB, which induces the expression of anti-apoptotic genes such as Bcl-2. cIAP1/2 inhibit TNF-α signaling by binding to TRAF2. FLIP inhibits the activation of caspase-8.

Selected Reviews:

Arya, R. et al. (2007) Heat shock genes - integrating cell survival and death. *J. Biosci.* 32, 595–610.

Brumatti, G. et al. (2010) Crossing paths: interactions between the cell death machinery and growth factor survival signals. *Cell. Mol. Life Sci.* 67, 1619–1630.

Fan, Y. et al. (2008) Regulation of programmed cell death by NF-kappaB and its role in tumorigenesis and therapy. *Adv. Exp. Med. Biol.* 615, 223–250.

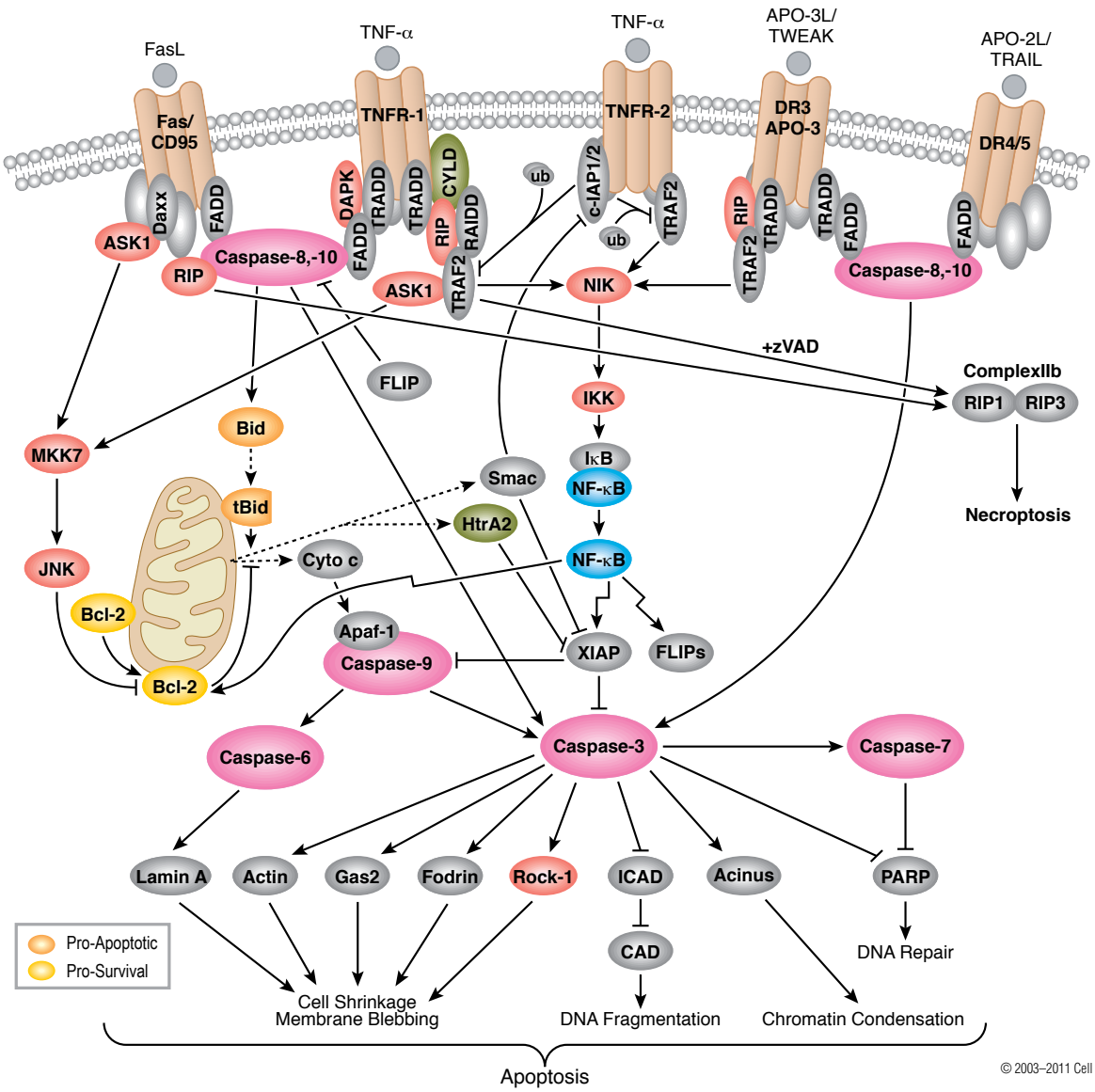
Rong, Y. and Distelhorst, C.W. (2008) Bcl-2 protein family members: versatile regulators of calcium signaling in cell survival and apoptosis. *Annu. Rev. Physiol.* 70, 73–91.

Srinivasula, S.M. and Ashwell, J.D. (2008) IAPs: what's in a name? *Mol. Cell* 30, 123–135.

Zakeri, Z. and Lockshin, R.A. (2008) Cell death: history and future. *Adv. Exp. Med. Biol.* 615, 1–11.

Signaling Pathways

Death Receptor Signaling



Pathway Description: Apoptosis can be induced through the activation of death receptors including Fas, TNFαR, DR3, DR4, and DR5 by their respective ligands. Death receptor ligands characteristically initiate signaling via receptor oligomerization, which in turn results in the recruitment of specialized adaptor proteins and activation of caspase cascades. Binding of FasL induces Fas trimerization, which recruits initiator caspase-8 via the adaptor protein FADD. Caspase-8 then oligomerizes and is activated via autocatalysis. Activated caspase-8 stimulates apoptosis via two parallel cascades: it can directly cleave and activate caspase-3, or alternatively, it can cleave Bid, a pro-apoptotic Bcl-2 family protein. Truncated Bid (tBid) translocates to mitochondria, inducing cytochrome c release, which sequentially activates caspase-9 and -3. TNF-α and DR-3L can deliver pro- or anti-apoptotic signals. TNFαR and DR3 promote apoptosis via the adaptor proteins TRADD/FADD and the activation of caspase-8. Interaction of TNF-α with TNFαR may activate the NF-κB pathway via NIK/IKK. The activation of NF-κB induces the expression of pro-survival genes including Bcl-2 and FLIP, the latter can directly inhibit the activation of caspase-8. FasL and TNF-α may also activate JNK via ASK1/MKK7. Activation of JNK may lead to the inhibition of Bcl-2 by phosphorylation. In the absence of caspase activation, stimulation of death receptors can lead to the activation of an alternative programmed cell death pathway termed necroptosis by forming complex IIb.

Selected Reviews:

Declercq, W. et al. (2009) RIP kinases at the crossroads of cell death and survival. *Cell* 138, 229–232.

Humphreys, R.C. and Halpern, W. (2008) Trail receptors: targets for cancer therapy. *Adv. Exp. Med. Biol.* 615, 127–158.

Logue, S.E. and Martin, S.J. (2008) Caspase activation cascades in apoptosis. *Biochem. Soc. Trans.* 36, 1–9.

Van Herreweghe, F. et al. (2010) Tumor necrosis factor-mediated cell death: to break or to burst, that's the question. *Cell. Mol. Life Sci.* 67, 1567–1579.

Zakeri, Z. and Lockshin, R.A. (2008) Cell death: history and future. *Adv. Exp. Med. Biol.* 615, 1–11.

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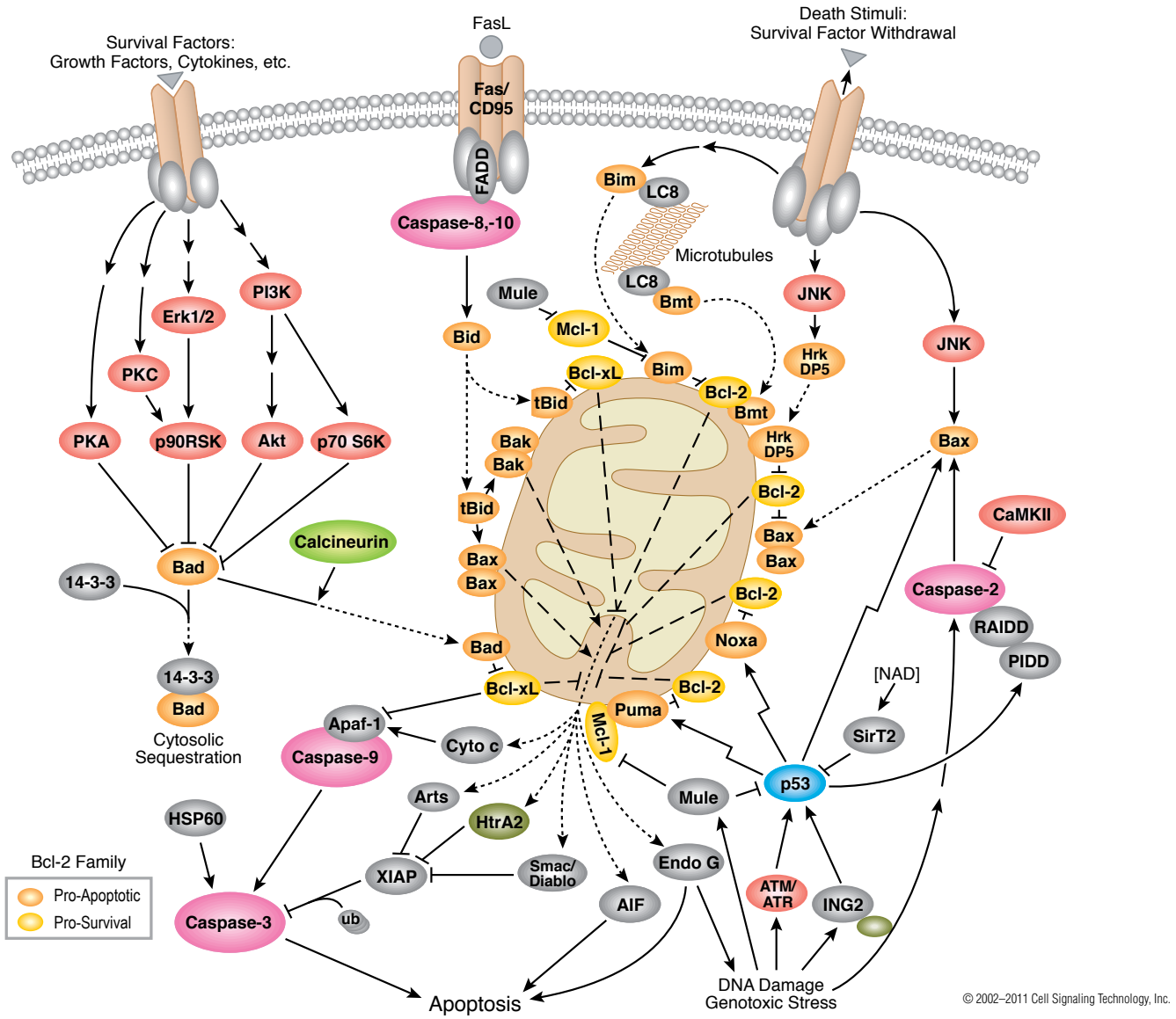
Mitochondrial Control of Apoptosis



Pathway Description: The Bcl-2 family of proteins regulate apoptosis by controlling mitochondrial permeability. The anti-apoptotic proteins Bcl-2 and Bcl-xL reside in the outer mitochondrial wall and inhibit cytochrome c release. The proapoptotic Bcl-2 proteins Bad, Bid, Bax, and Bim may reside in the cytosol but translocate to mitochondria following death signaling, where they promote the release of cytochrome c. Bad translocates to mitochondria and forms a pro-apoptotic complex with Bcl-xL. This translocation is inhibited by survival factors that induce the phosphorylation of Bad, leading to its cytosolic sequestration. Cytosolic Bid is cleaved by caspase-8 following signaling through Fas; its active fragment (tBid) translocates to mitochondria. Bax and Bim translocate to mitochondria in response to death stimuli, including survival factor withdrawal. Activated following DNA damage, p53 induces the transcription of Bax, Noxa, and PUMA. Upon release from mitochondria, cytochrome c binds to Apaf-1 and forms an activation complex with caspase-9. Although the mechanism(s) regulating mitochondrial permeability and the release of cytochrome c during apoptosis are not fully understood, Bcl-xL, Bcl-2, and Bax may influence the voltage-dependent anion channel (VDAC), which may play a role in regulating cytochrome c release. Mule/ARF-BP1 is a DNA damage activated E3 ubiquitin ligase for p53, and Mcl-1, an anti-apoptotic member of Bcl-2.

Selected Reviews:

Brenner, D. and Mak, T.W. (2009) Mitochondrial cell death effectors. *Curr. Opin. Cell Biol.* 21, 871–877.

Chalah, A. and Khosravi-Far, R. (2008) The mitochondrial death pathway. *Adv. Exp. Med. Biol.* 615, 25–45.

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Rong, Y. and Distelhorst, C.W. (2008) Bcl-2 protein family members: versatile regulators of calcium signaling in cell survival and apoptosis. *Annu. Rev. Physiol.* 70, 73–91.

Speidel D. (2010) Transcription-independent p53 apoptosis: an alternative route to death. *Trends Cell Biol.* 20, 14–24.

Suen, D.F. et al. (2008) Mitochondrial dynamics and apoptosis. *Genes Dev.* 22, 1577–1590.

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Tel: 978-867-2300
E-mail: info@cellsignal.com

International Subsidiaries

Cell Signaling Technology (China) Limited
Tel: (86) 21-5835-6288
E-mail: info@cst-c.com.cn

Cell Signaling Technology Europe
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