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Immortalized cell lines used with NucView™488 Caspase-3 Substrate

Cell line	Species	Cell type	References
293-H	Human	Embryonic kidney	Wu and MacRae 2010
293-T	Human	Embryonic kidney	Li et al. 2008
4T1	Mouse	Mammary tumor	Granot et al. 2011
67NR	Mouse	Mammary carcinoma	Cheng et al. 2009
A172	Human	Glioma	Jeong et al. 2009
A204	Human	Sarcoma	Zhu et al. 2008
B16F10	Mouse	Melanoma	Ferreira et al. 2011
BeWo	Human	Trophoblast	Angeloni et al. 2009
CCL-134	Human	IPF pulmonary fibroblast	Vuorinen et al. 2007
CCL-190	Human	Pulmonary fibroblast	Vuorinen et al. 2007
GE11	Mouse	Epithelial	Puigvert et al. 2009
HaCaT	Human	Keratinocyte	Paromov et al. 2011
HCLE	Human	Corneal epithelial	Mankus et al. 2011
HeLa	Human	Cervical cancer	Angeloni et al. 2009; Antczak et al. 2009; Cen et al. 2008
HepT1	Human	Hepatoblastoma	Eicher et al. 2011; Dewerth et al. 2012
HMEC	Human	Microvascular endothelial	Isherwood et al. 2011
HT-1080	Human	Breast fibrosarcoma	Wang et al. 2010; Zhu et al. 2008
HUH6	Human	Hepatoblastoma	Eicher et al. 2011; Dewerth et al. 2012
Jurkat	Human	T-lymphocyte	Cen et al. 2008; Stewart et al. 2010
JY	Human	Lymphoblastic leukemia	Berenyi et al. 2011
K562	Human	Myelogenous leukaemia	Sztiller-Sikorska et al. 2009
LLC-PK1	Pig	Kidney epithelial	Queisser 2010
MCF-7	Human	Breast adenocarcinoma	Balijepalli et al. 2010
MDA-MB-231	Human	Breast adenocarcinoma	Balijepalli et al. 2010, Aronchik et al. 2011
MDCK	Canine	Kidney epithelial	Queisser 2010; Eisenhoffer et al. 2012
MES-SA	Human	Uterine sarcoma	Zhu et al. 2008
MES-SA/DX	Human	Uterine sarcoma	Zhu et al. 2008
Min 6	Mouse	Pancreatic insulinoma	Pathak et al. 2008
N19	Mouse	Oligodendrocyte	Paez et al. 2007, Smith et al. 2012
NRK	Rat	Kidney epithelial	Stopper et al. 2009
NRK-52E	Rat	Kidney epithelial	Katsoulieris et al. 2010
PC-3	Human	Prostate cancer	Björkman et al. 2011
PC12	Rat	Pheochromocytoma	Stopper et al. 2009
RD	Human	Rhabdomyosarcoma	Zhu et al. 2008
RINm5F	Rat	Insulinoma	Schmitt et al. 2011
SKLMS1	Human	Leiomyosarcoma	Wang et al. 2010; Zhu et al. 2008
SW684	Human	Fibrosarcoma	Zhu et al. 2008
SW872	Human	Liposarcoma	Zhu et al. 2008

THP-1	Human	Monocyte	Cestari et al. 2012
TK6	Human	TK6	Stopper et al. 2009
U2OS	Human	Osteosarcoma	Benetti and Roizman 2007; Klotz et al. 2012
U251	Human	Glioblastoma	Overmeyer et al. 2008
U373 MG	Human	Glioblastoma	Jones and Howl 2011
WEHI 7.2	Mouse	Lymphoid	Monaco et al. 2011

Primary cell types used with NucView™488 Caspase-3 Substrate

Cell type	Species	References
Alveolar epithelial cells	Mouse	Standiford et al. 2012
Dendritic cells	Mouse	Brodsky and Medzhitov 2008
Embryonic fibroblast (MEF)	Mouse	Chen et al. 2010; Handa et al. 2011
Hepatocytes	Rat	Zhang et al. 2011
Hippocampal neurons	Rat	Volosin et al. 2008
Idopathic pulmonary fibrosis fibroblasts	Human	Vuorinen et al. 2007
Immature B cells	Mouse	Claudio et al. 2009
Kidney epithelial cells	Mouse	Leuenroth et al. 2007; Schmid et al. 2008
Lung microvascular endothelial cells	Human	Mackay et al. 2010
Macrophages	Mouse	Brodsky and Medzhitov 2008
Mammary epithelial cells (3-D cultures)	Mouse	Jechlinger et al. 2009
SVZ neural progenitor cells	Rat	Teng et al. 2008
Oligodendrocytes	Mouse	Paez et al. 2009; Guardia Clausi et al. 2012
Oocytes	Bovine, mouse	Kujjo et al. 2012
Pancreatic acinar cells	Mouse	Adhikari et al. 2008
Pancreatic beta cells	Rat	Dufer et al. 2010; Schmitt et al. 2011
Pancreatic islet cells	Mouse	Gier et al. 2009
Peritoneal macrophages	Mouse	Yancey et al. 2010, Hanley et al. 2012
Pollen tubes	Field poppy (*Papaver rhoeas*)	Bosch and Franklin-Tong 2007
Retinal pigmented epithelial cells	Human, mouse	Yang et al. 2009; Yang et al. 2011
Skin fibroblasts	Sand cat (*Felis margarita*)	Gomez et al. 2008
Thymocytes	Mouse	Tribulatti et al. 2007
Umbilical vein endothelial cells	Human	Geng et al. 2009

References

Adhikari, S. (2008). Role of mitogen-activated protein kinases in crambene-induced pancreatic acinar cell apoptosis. International Journal of Integrative Biology 3, 25.

Angeloni, M.B., Silva, N.M., Castro, A.S., Gomes, A.O., Silva, D.A., Mineo, J.R., and Ferro, E.A. (2009). Apoptosis and S phase of the cell cycle in BeWo trophoblastic and HeLa cells are differentially modulated by Toxoplasma gondii strain types. Placenta 30, 785-791.

Antczak, C., Takagi, T., Ramirez, C.N., Radu, C., and Djaballah, H. (2009). Live-cell imaging of caspase activation for high-content screening. J Biomol Screen 14, 956-969.

Aronchik, I., Chen, T., Durkin, K.A., Horwitz, M.S., Preobrazhenskaya, M.N., Bjeldanes, L.F., and Firestone, G.L. (2011). Target protein interactions of indole-3-carbinol and the highly potent derivative 1-Benzyl-I3C with the C-terminal domain of human elastase uncouples cell cycle arrest from apoptotic signaling. Mol Carcinog. doi: 10.1002/mc.20857

Balijepalli, M. (2010). Antiproliferative activity and induction of apoptosis in estrogen receptor-positive and negative human breast carcinoma cell lines by Gmelina asiatica roots. Pharmacognosy Research 2, 113-119.

Benetti, L., and Roizman, B. (2007). In transduced cells, the US3 protein kinase of herpes simplex virus 1 precludes activation and induction of apoptosis by transfected procaspase 3. J Virol 81, 10242-10248.

Berenyi, E., Benko, I., Vamosi, G., Geresi, K., Tarkanyi, I., Szegedi, I., Lukacs, L., Juhasz, I., Kiss, C., Fesus, L., et al. (2011). In vitro and in vivo activity of 4-thio-uridylate against JY cells, a model for human acute lymphoid leukemia. Biochem Biophys Res Commun 410, 682-687.

Bjorkman, M., Ostling, P., Harma, V., Virtanen, J., Mpindi, J.P., Rantala, J., Mirtti, T., Vesterinen, T., Lundin, M., Sankila, A., et al. (2011). Systematic knockdown of epigenetic enzymes identifies a novel histone demethylase PHF8 overexpressed in prostate cancer with an impact on cell proliferation, migration and invasion. Oncogene. doi: 10.1038/onc.2011.512

Bosch, M., and Franklin-Tong, V.E. (2007). Temporal and spatial activation of caspase-like enzymes induced by self-incompatibility in Papaver pollen. Proc Natl Acad Sci U S A 104, 18327-18332.

Brodsky, I.E., and Medzhitov, R. (2008). Reduced secretion of YopJ by Yersinia limits in vivo cell death but enhances bacterial virulence. PLoS Pathog 4, e1000067.

Cen, H., Mao, F., Aronchik, I., Fuentes, R.J., and Firestone, G.L. (2008). DEVD-NucView488: a novel class of enzyme substrates for real-time detection of caspase-3 activity in live cells. FASEB J 22, 2243-2252.

Cestari I., Ansa-Addo E., Deolindo P., Inal J.M., Ramirez M.I. (2012). Trypanosoma cruzi Immune Evasion Mediated by Host Cell-Derived Microvesicles. J. Immunol. doi:10.4049/jimmunol.1102053

Chen, Y., Lewis, W., Diwan, A., Cheng, E.H., Matkovich, S.J., and Dorn, G.W., 2nd (2010). Dual autonomous mitochondrial cell death pathways are activated by Nix/BNip3L and induce cardiomyopathy. Proc Natl Acad Sci U S A 107, 9035-9042.

Cheng, G., Tse, J., Jain, R.K., and Munn, L.L. (2009). Micro-environmental mechanical stress controls tumor spheroid size and morphology by suppressing proliferation and inducing apoptosis in cancer cells. PLoS One 4, e4632.

Claudio, E., Saret, S., Wang, H., and Siebenlist, U. (2009). Cell-autonomous role for NF-kappa B in immature bone marrow B cells. J Immunol 182, 3406-3413.

Dewerth, A., Wonner, T., Lieber, J., Ellerkamp, V., Warmann, S.W., Fuchs, J., and Armeanu-Ebinger, S. (2012). In vitro evaluation of the Aurora kinase inhibitor VX-680 for Hepatoblastoma. Pediatr Surg Int. doi: 10.1007/s00383-012-3086-6

Dufer, M., Neye, Y., Horth, K., Krippeit-Drews, P., Hennige, A., Widmer, H., McClafferty, H., Shipston, M.J., Haring, H.U., Ruth, P., et al. (2011). BK channels affect glucose homeostasis and cell viability of murine pancreatic beta cells. Diabetologia 54, 423-432.

Eicher, C., Dewerth, A., Kirchner, B., Warmann, S.W., Fuchs, J., and Armeanu-Ebinger, S. (2011). Treatment effects of the multikinase inhibitor sorafenib on hepatoblastoma cell lines and xenografts in NMRI-Foxn1(nu) mice. Liver Int. doi: 10.1111/j.1478-3231.2011.02729.x

Eisenhoffer, G.T., Loftus, P.D., Yoshigi, M., Otsuna, H., Chien, C.B., Morcos, P.A., and Rosenblatt, J. (2012). Crowding induces live cell extrusion to maintain homeostatic cell numbers in epithelia. Nature. doi:10.1038/nature10999

Ferreira AK, Meneguelo R, Neto SC, Chierice GO, and Maria DA. (2011). Synthetic Phosphoethanolamine Induces Apoptosis Through Caspase-3 Pathway by Decreasing Expression of Bax/Bad Protein and Changes Cell Cycle in Melanoma. J Cancer Sci Ther 3: 053-059.

Geng, L., Rachakonda, G., Morre, D.J., Morre, D.M., Crooks, P.A., Sonar, V.N., Roti, J.L., Rogers, B.E., Greco, S., Ye, F., et al. (2009). Indolyl-quinuclidinols inhibit ENOX activity and endothelial cell morphogenesis while enhancing radiation-mediated control of tumor vasculature. FASEB J 23, 2986-2995.

Gier, B., Krippeit-Drews, P., Sheiko, T., Aguilar-Bryan, L., Bryan, J., Dufer, M., and Drews, G. (2009). Suppression of KATP channel activity protects murine pancreatic beta cells against oxidative stress. J Clin Invest 119, 3246-3256.

Gomez, M.C., Pope, C.E., Kutner, R.H., Ricks, D.M., Lyons, L.A., Ruhe, M., Dumas, C., Lyons, J., Lopez, M., Dresser, B.L., et al. (2008). Nuclear transfer of sand cat cells into enucleated domestic cat oocytes is affected by cryopreservation of donor cells. Cloning Stem Cells 10, 469-483.

Granot, Z., Henke, E., Comen, E.A., King, T.A., Norton, L., and Benezra, R. (2011). Tumor entrained neutrophils inhibit seeding in the premetastatic lung. Cancer Cell 20, 300-314.

Guardia Clausi, M., Paez, P.M., Campagnoni, A.T., Pasquini, L.A., and Pasquini, J.M. (2012). Intranasal administration of aTf protects and repairs the neonatal white matter after a cerebral hypoxic-ischemic event. Glia. doi:10.1002/glia.22374

Handa, P., Tupper, J.C., Jordan, K.C., and Harlan, J.M. (2011). FLIP (Flice-like inhibitory protein) suppresses cytoplasmic double-stranded-RNA-induced apoptosis and NF-kappaB and IRF3-mediated signaling. Cell Commun Signal 9, 16.

Hanley, P.J., Kronlage, M., Kirschning, C., Del Rey, A., Di Virgilio, F., Leipziger, J., Chessell, I.P., Sargin, S., Filippov, M.A., Lindemann, O., et al. (2012). Transient P2x7 Receptor Activation Triggers Macrophage Death Independent of Tlr2/4, Casp1 and Panx1. J Biol Chem. 287,10650–10663.

Isherwood, B. (2011). Live Cell in Vitro and in Vivo Imaging Applications: Accelerating Drug Discovery. Pharmaceutics 3, 141.

Jechlinger, M., Podsypanina, K., and Varmus, H. (2009). Regulation of transgenes in three-dimensional cultures of primary mouse mammary cells demonstrates oncogene dependence and identifies cells that survive deinduction. Genes Dev 23, 1677-1688.

Jeong, J.C., Kim, M.S., Kim, T.H., and Kim, Y.K. (2009). Kaempferol induces cell death through ERK and Akt-dependent down-regulation of XIAP and survivin in human glioma cells. Neurochem Res 34, 991-1001.

Jones, S. and Howl, J. (2011). Cell-Penetrating Peptides: Methods and Protocols. Methods in Molecular Biology 683, 291-303.

Katsoulieris, E., Mabley, J.G., Samai, M., Sharpe, M.A., Green, I.C., and Chatterjee, P.K. (2010). Lipotoxicity in renal proximal tubular cells: relationship between endoplasmic reticulum stress and oxidative stress pathways. Free Radic Biol Med 48, 1654-1662.

Klotz, D.M., Nelson, S.A., Kroboth, K., Newton, I.P., Radulescu, S., Ridgway, R.A., Sansom, O.J., Appleton, P.L., and Nathke, I.S. (2012). The microtubule poison vinorelbine kills cells independently of mitotic arrest and targets cells lacking the APC tumour suppressor more effectively. J Cell Sci. doi: 10.1242/jcs.091843

Kujjo, L.L., Ronningen, R., Ross, P., Pereira, R.J.G., Ramon Rodriguez, R., Beyhan, Z., Marcelo D., Goissis, M.D., Baumann, T., Kagawa, W., Camsari, C., Smith, G.W., Kurumizaka, H., Yokoyama, S., Cibelli, J.B., Perez, G.I. (2012). RAD51 plays a crucial role in halting cell death program induced by ionizing radiation in bovine oocytes. Biol. Reprod. doi:10.1095/biolreprod.111.092064

Leuenroth, S.J., Okuhara, D., Shotwell, J.D., Markowitz, G.S., Yu, Z., Somlo, S., and Crews, C.M. (2007). Triptolide is a traditional Chinese medicine-derived inhibitor of polycystic kidney disease. Proc Natl Acad Sci U S A 104, 4389-4394.

Li, K., Li, Y., Wu, W., Gordon, W.R., Chang, D.W., Lu, M., Scoggin, S., Fu, T., Vien, L., Histen, G., et al. (2008). Modulation of Notch signaling by antibodies specific for the extracellular negative regulatory region of NOTCH3. J Biol Chem 283, 8046-8054.

Mackay, L. S., Dodd, S., Tomlinson, W., Dougall, I., Walden, H., Isherwood, B., Gardner, A., Borthwick, L., Pinnion Brown, K., Foster, M., Fisher, A.J., and Corris, P.A. (2010). Microvascular endothelial cell apoptosis and dysregulation of vascular endothelial growth factor receptor 2 (VEGF-R2) in response to cigarette smoke. New insights into the pathogenesis of emphysema. Thorax. doi:10.1136/thx.2010.150946.47

Mankus, C., Rich, C., Minns, M., and Trinkaus-Randall, V. (2011). Corneal Epithelium Expresses a Variant of P2X(7) Receptor in Health and Disease. PLoS One 6, e28541.

Monaco, G., Decrock, E., Akl, H., Ponsaerts, R., Vervliet, T., Luyten, T., De Maeyer, M., Missiaen, L., Distelhorst, C.W., De Smedt, H., et al. (2011). Selective regulation of IP(3)-receptor-mediated Ca(2+) signaling and apoptosis by the BH4 domain of Bcl-2 versus Bcl-Xl. Cell Death Differ. doi: 10.1038/cdd.2011.97

Overmeyer, J.H., Kaul, A., Johnson, E.E., and Maltese, W.A. (2008). Active ras triggers death in glioblastoma cells through hyperstimulation of macropinocytosis. Mol Cancer Res 6, 965-977.

Paez, P.M., Spreuer, V., Handley, V., Feng, J.M., Campagnoni, C., and Campagnoni, A.T. (2007). Increased expression of golli myelin basic proteins enhances calcium influx into oligodendroglial cells. J Neurosci 27, 12690-12699.

Paez, P.M., Fulton, D.J., Spreuer, V., Handley, V., Campagnoni, C.W., and Campagnoni, A.T. (2009). Regulation of store-operated and voltage-operated Ca2+ channels in the proliferation and death of oligodendrocyte precursor cells by golli proteins. ASN Neuro 1. pii: e00003. doi: 10.1042/AN20090003

Paromov V, Brannon M, Kumari S, Samala M, Qui M, Smith M, and Stone WL. (2011). Sodium pyruvate modulates cell death pathways in HaCaT keratinocytes exposed to half-mustard gas. Int. J. Toxicol. doi: 10.1177/1091581810390824

Pathak, S., Dorfmueller, H.C., Borodkin, V.S., and van Aalten, D.M. (2008). Chemical dissection of the link between streptozotocin, O-GlcNAc, and pancreatic cell death. Chem Biol 15, 799-807.

Puigvert, J.C., Huveneers, S., Fredriksson, L., op het Veld, M., van de Water, B., and Danen, E.H. (2009). Cross-talk between integrins and oncogenes modulates chemosensitivity. Mol Pharmacol 75, 947-955.

Queisser, N. Oxidative and nitrosative stress induced by the mineralocorticoid aldosterone. Mechanism of induction and role of signal transduction pathways and transcription factors. Ph.D. dissertation, University of Wurzburg. (URN (NBN): urn:nbn:de:bvb:20-opus-53566).

Schmid, U., Stopper, H., Schweda, F., Queisser, N., and Schupp, N. (2008). Angiotensin II induces DNA damage in the kidney. Cancer Res 68, 9239-9246.

Schmitt, H., Lenzen, S., and Baltrusch, S. (2011). Glucokinase mediates coupling of glycolysis to mitochondrial metabolism but not to beta cell damage at high glucose exposure levels. Diabetologia. doi: 10.1007/s00125-011-2133-5

Smith, G.S., Voyer-Grant, J.A., Harauz, G. (2012). Monitoring Cleaved Caspase-3 Activity and Apoptosis of Immortalized Oligodendroglial Cells using Live-cell Imaging and Cleaveable Fluorogenic-dye Substrates Following Potassium-induced Membrane Depolarization. J. Vis. Exp. 59, e3422, doi : 10.3791/3422

Standiford, L.R., Standiford, T.J., Newstead, M.J., Zeng, X., Ballinger, M.N., Kovach, M.A., Reka, A.K., and Bhan, U. (2012). TLR4-dependent GM-CSF protects against lung injury in Gram-negative bacterial pneumonia. Am J Physiol Lung Cell Mol Physiol 302, L447-454.

Stewart, S.G., Braun, C.J., Ng, S.L., Polomska, M.E., Karimi, M., and Abraham, L.J. (2010). New thalidomide analogues derived through Sonogashira or Suzuki reactions and their TNF expression inhibition profiles. Bioorg Med Chem 18, 650-662.

Stopper, H., Schupp, N., Fazeli, G., Dietel, B., Queisser, N., Walitza, S., and Gerlach, M. (2009). Genotoxicity of the neurotransmitter dopamine in vitro. Toxicol In Vitro 23, 640-646.

Sztiller-Sikorska, M., Jakubowska, J., Wozniak, M., Stasiak, M., and Czyz, M. (2009). A non-apoptotic function of caspase-3 in pharmacologically-induced differentiation of K562 cells. Br J Pharmacol 157, 1451-1462.

Teng, H., Zhang, Z.G., Wang, L., Zhang, R.L., Zhang, L., Morris, D., Gregg, S.R., Wu, Z., Jiang, A., Lu, M., et al. (2008). Coupling of angiogenesis and neurogenesis in cultured endothelial cells and neural progenitor cells after stroke. J Cereb Blood Flow Metab 28, 764-771.

Tribulatti, M.V., Mucci, J., Cattaneo, V., Aguero, F., Gilmartin, T., Head, S.R., and Campetella, O. (2007). Galectin-8 induces apoptosis in the CD4(high)CD8(high) thymocyte subpopulation. Glycobiology 17, 1404-1412.

Volosin, M., Trotter, C., Cragnolini, A., Kenchappa, R.S., Light, M., Hempstead, B.L., Carter, B.D., and Friedman, W.J. (2008). Induction of proneurotrophins and activation of p75NTR-mediated apoptosis via neurotrophin receptor-interacting factor in hippocampal neurons after seizures. J Neurosci 28, 9870-9879.

Vuorinen, K., Gao, F., Oury, T.D., Kinnula, V.L., and Myllarniemi, M. (2007). Imatinib mesylate inhibits fibrogenesis in asbestos-induced interstitial pneumonia. Exp Lung Res 33, 357-373.

Wang, S., Ren, W., Liu, J., Lahat, G., Torres, K., Lopez, G., Lazar, A.J., Hayes-Jordan, A., Liu, K., Bankson, J., et al. (2010). TRAIL and doxorubicin combination induces proapoptotic and antiangiogenic effects in soft tissue sarcoma in vivo. Clin Cancer Res 16, 2591-2604.

Wu, Y., and MacRae, T.H. (2010). Truncation attenuates molecular chaperoning and apoptosis inhibition by p26, a small heat shock protein from Artemia franciscana. Biochem Cell Biol 88, 937-946.

Yancey, P.G., Blakemore, J., Ding, L., Fan, D., Overton, C.D., Zhang, Y., Linton, M.F., and Fazio, S. (2010). Macrophage LRP-1 controls plaque cellularity by regulating efferocytosis and Akt activation. Arterioscler Thromb Vasc Biol 30, 787-795.

Yang, D., Elner, S.G., Chen, X., Field, M.G., Petty, H.R., and Elner, V.M. (2011). MCP-1-activated monocytes induce apoptosis in human retinal pigment epithelium. Invest Ophthalmol Vis Sci 52, 6026-6034.

Yang, D., Elner, S.G., Lin, L.R., Reddy, V.N., Petty, H.R., and Elner, V.M. (2009). Association of superoxide anions with retinal pigment epithelial cell apoptosis induced by mononuclear phagocytes. Invest Ophthalmol Vis Sci 50, 4998-5005.

Zhang, Y., Dong, L., Yang, X., Shi, H., and Zhang, L. (2011). alpha-Linolenic acid prevents endoplasmic reticulum stress-mediated apoptosis of stearic acid lipotoxicity on primary rat hepatocytes. Lipids Health Dis 10, 81.

Zhu, Q.S., Ren, W., Korchin, B., Lahat, G., Dicker, A., Lu, Y., Mills, G., Pollock, R.E., and Lev, D. (2008). Soft tissue sarcoma cells are highly sensitive to AKT blockade: a role for p53-independent up-regulation of GADD45 alpha. Cancer Res 68, 2895-2903.