

# Biofiles

A microscopic image of several cells, likely fibroblasts, with glowing green outlines and bright yellow-orange nuclei, set against a dark background.

Volume 5, Number 8

SIGMA-ALDRICH®

**SIGMA** Where *bio* begins™  
Life Science

## Cell-Based Assays

Assays and Reagents for Measuring Cytotoxicity,  
Proliferation, and Viability

Apoptosis

Autophagy

Reactive Oxygen Species

LOPAC® Library

Cell and Organelle Labeling

Cell Culture

Cell Culture Labware

# Biofilesonline

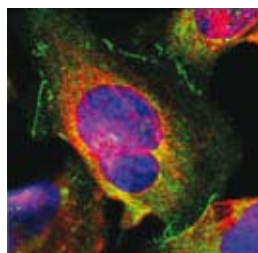
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for Life Science Research



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## Highlights from this issue:

### Cell-Based Assays

This is the first Biofiles to touch on the broad subject of cell-based assays. Within this issue we have assembled a broad offering of reagents, kits and labware and have added over 1,500 ECACC® cell lines to our U.S. portfolio. Given the growing understanding and importance of autophagy, we have compiled a selection of products for induction, inhibition and monitoring of autophagy in cells.



## Coming Next Issue: Drug Metabolism

The next issue of Biofiles will feature our drug metabolism platform developed over more than forty years. Of special interest will be cellular drug transport including proteins and antibodies. "Next generation" cytochrome P450 enzymes are being introduced along with new antibodies, additional Phase I oxidases and P450 modulators. Also included will be the most extensive portfolio of enzymes and analytical tools for drug metabolite analysis in biological fluids.

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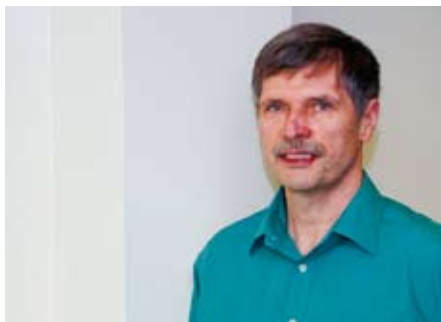
Cover: Image titled "Cells" by Sebastian Kaulitzki. The image emphasizes the simplicity of life's most fundamental unit, the cell.

Technical content: Linda Stephenson PhD. and  
Jeremy Benedick M.Sc.

# Introduction

## Don Finley

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The challenge of understanding the biology of living organisms, including disease processes, is in its incredible complexity. Scientists early on realized the value in utilizing life's most fundamental unit, the cell. Many aspects of living organisms are analyzed based on studies of living cells from cell signaling, proliferation, apoptosis, cellular genetics/morphology, neurobiology, cancer and more.

In both the pharma industry and academic research, the term cell-based assay is commonly used to refer to any assay based on some measurement of a living cell.

The pharmaceutical industry's need to efficiently commercialize drugs is a driving force in cell-based assay innovation. The industry is hoping to utilize cell-based assays to help reverse the increasing trend of costly late-stage drug failures. Having an Investigational New Drug (IND) candidate fail in phase III clinical trials can result in a loss of several hundred million dollars for that company. It is reported that with the current level of late-stage failures the return on investment for pharmaceutical companies could drop as low as 5%, which is an unacceptable level for most companies.

A lot of scientific resources are being poured into cell-based methodologies. The promise these technologies need to fulfill is daunting and the phrase "fail early" is an over-simplification. There is a need for rapid cell-based methodologies to predict with a high degree of accuracy which IND will be successful through to commercialization.

Drugs are failing for a number of reasons. While animal models are commonly used for toxicity and metabolism studies of INDs, they are both expensive and low-throughput

which usually limits their use to late stages of preclinical testing. Additionally, animal models may not always replicate human metabolism which results in late-stage failures due to unforeseen toxicity issues. Adverse drug reactions (ADRs) due to idiosyncratic differences in humans are another cause of late-stage drug failures. For example, Troglitazone, a type II diabetes drug, was taken off the market 3 years after release due to a small number of cases of drug-induced hepatitis. ADRs due to idiosyncratic differences tend to be rare events and even large clinical phase III trials could fail to detect the low rate (about 1 in 10,000) of idiosyncratic liver failure typical of this type of safety issue.

Many cell-based methodologies are being considered but so far no single technology or group of technologies has been reported to improve the late-stage failure rate. One important consideration is the cell type used for the metabolic and toxicity testing. Primary cells are often preferred over long-term established cell lines because they are thought to more closely replicate "real cells". However, primary cells are variable and often can only be cultured for a few passages before they reach senescence or undergo undesirable phenotypic changes. Established cells have the benefit of phenotypic stability and ease of culture and are used extensively for cell-based assays. For example, cell lines like HepG2 and NIH/3T3 are ideal for testing mitochondrial toxicity because of their anaerobic metabolism. However, in regards to liver toxicity studies, established hepatocytic lines are less than ideal because they only weakly express cytochrome P450 enzymes.

Current research is investigating the use of induced pluripotent stem cells (iPSCs)

for creating better *in vitro* models for drug studies. For example, differentiated stem cells may be better models for studying drug-induced liver injury than primary hepatocytes as they maintain function longer than primary cells. ADRs due to idiosyncratic events are often due to patient-specific susceptibility factors such as genetic variations. One proposal to address this issue is to create large libraries of iPSCs that can be differentiated to hepatocytes as the basis for an automated assay.

Another limitation to traditional cell-based assays is a geometric issue. Most cell culture assays are performed in two dimensions while the real world of an *in vivo* cell is three-dimensional. 3-D cell culture can better create or mimic the extracellular environment (geometric shapes, scaffolding, forces placed on cells) so that cells will react to stimuli, toxins etc. more like they would *in vivo*.

A broad offering of products from Sigma® Life Science are used in cell-based assays that are suitable for both pharma and academic applications. We have broadened our U.S. offering of established cell lines and hybridomas to include over 1500 cell lines from the European Collection of Cell Cultures (ECACC®). ECACC cell lines are guaranteed to be authenticated and mycoplasma free.

We have the best selection of reagents and biologically active compounds in the industry. Our LOPAC® library makes accessing these compounds far easier than ever with thousands of pre-dispensed compounds on 96-well plates. In addition, we offer an exhaustive collection of Prestige Antibodies® for detection of a wide variety of cellular organelles and gene products that serve the basis for a broad variety of cell-based assay applications.

Sigma has applied the revolutionary CompoZr® Zinc Finger Nuclease technology to create an unparalleled range of genetically modified mammalian cell lines for use in areas such as basic research, target validation, drug discovery and drug development. With targeted and heritable gene deletions, integrations, or modifications our isogenic cell lines give you the tools to take your research to new heights. In the coming months you can expect a number of cell lines that will enable cell-based assay innovation never before possible.

#### References:

- (1) Tsaïoun, K., Bottlaender, M., Mabondzo, A. ADDME - Avoiding Drug Development Mistakes Early: central nervous system drug discovery perspective. *BMC Neurol.* **9**, S1–11 (2009).
- (2) Gilbert, J., Henske, P., Singh, A. Rebuilding Big Pharma's Business Model. *The Business & Medicine Report.* **21** (2003).
- (3) Shaw, R. Industrializing Stem Cell Production. *BioProcess Int.* **8**, 10–15 (2010).

*biohighlight*

## Nancy-520

A non-toxic and ultrasensitive stain for DNA detection.

- Higher sensitivity compared to Ethidium bromide and SYBR Green I
- Fast and reliable staining (1 h)
- Lower mutagenicity than Ethidium bromide and SYBR® Green I according to Ames test
- For the detection of dsDNA on Agarose Gel Electrophoresis and for the determination of DNA in solutions
- Product Number 01494

[sigma.com/nancy520](http://sigma.com/nancy520)

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## Proliferation and Viability

# Assays and Reagents for Measuring Cytotoxicity, Proliferation and Viability

Assays to measure proliferation, viability and cytotoxicity are commonly used to monitor the response and health of cells in culture after treatment with various stimuli. The proper choice of an assay method depends on the number and type of cells used as well as the expected outcome. Assays for cell proliferation may monitor the number of cells over time, the number of cellular divisions, metabolic activity or DNA synthesis. Cell counting using viability dyes such as trypan blue or calcein-AM can provide both the rate of proliferation as well as the percentage of viable cells.

5(6)-Carboxyfluorescein diacetate N-succinimidyl ester (CFSE) is a popular choice for measuring the number of cellular divisions a population has undergone. Upon entering the cell, CFSE is cleaved by intracellular esterases to form the fluorescent compound and the succinimidyl ester group covalently reacts with primary amines on intracellular proteins. Upon division, the fluorescence intensity of each daughter cell is halved which allows for the simple detection of the number of cell divisions by flow cytometry.

Assays that measure metabolic activity are suitable for analyzing proliferation, viability, and cytotoxicity. The reduction of tetrazolium salts such as MTT and XTT to colored formazan compounds or the bioreduction of resazurin only occurs in metabolically active cells. Actively proliferating cells increase their metabolic activity while cells exposed to toxins will have decreased activity.

## Kits

### **In Vitro Toxicology Assay Kit, MTT based**

Conversion of MTT to a water-insoluble colored formazan derivative which is then solubilized in acidic isopropanol.

**TOX1-1KT** 1 kit

### **In Vitro Toxicology Assay Kit, XTT based**

Conversion of XTT to a water-soluble colored formazan derivative.

**TOX2-1KT** 1 kit

### **In Vitro Toxicology Assay Kit, Neutral Red based**

Neutral red is taken up by viable cells and stored in the lysosomes. The dye is extracted and the uptake is quantitated by spectroscopy.

**TOX4-1KT** 1 kit

### **In Vitro Toxicology Assay Kit, Sulforhodamine B based**

Dye binds to cellular protein and is then solubilized in base.

**TOX6-1KT** 1 kit

### **In Vitro Toxicology Assay Kit, Lactic Dehydrogenase based**

LDH reduces  $\text{NAD}^+$ , which then converts a tetrazolium dye to a soluble, colored formazan derivative.

**TOX7-1KT** 1 kit

### **In Vitro Toxicology Assay Kit, Resazurin based**

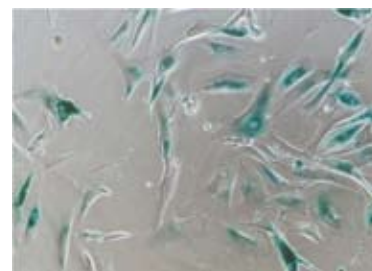
Bioreduction of the dye reduces the amount of its oxidized form (blue) and concomitantly increases the fluorescent intermediate (red).

**TOX8-1KT** 1 kit

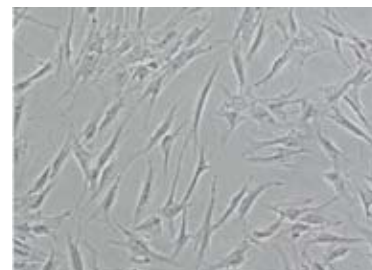
## **Senescent Cells Histochemical Staining Kit**

Replicative senescence is a growth-arrest state associated with loss of division potential, changes in cell morphology, shape and physical appearance, and the pattern of gene expression in cells.

Histochemical staining of  $\beta$ -galactosidase activity is performed at pH 6.0. Under these conditions,  $\beta$ -galactosidase is a biomarker specific for senescent cells, but is not found in quiescent, immortal, or tumor cells.



Human Foreskin Fibroblasts passage 28 (senescent cells)



Human Foreskin Fibroblasts passage 5 (control)

**Detection of senescent cells.** Primary Human Foreskin Fibroblasts (HFF) at early and late passages (5 and 28 passages, respectively) were stained using the Senescent Cell Staining Kit (Prod. No. **CS0030**). The HFF cells at passage 28 show a blue staining indicating that these cells are senescent, whereas at passage 5, senescent cells are absent.

**CS0030-1KT** 1 kit

### Cell Counting Kit

Cell Counting Kit is utilized for the fluorometric detection of the living cell numbers. The amount of a fluorescent dye, calcein, produced from Calcein-AM by esterases in cells is directly proportional to the number of viable cells in a culture media.

**03285-1KT-F** 1 kit

### Cell Counting Kit - 8

Cell Counting Kit-8 (CCK-8) allows convenient assays using WST-8 (2-(2-methoxy-4-nitrophenyl)-3-(4-nitrophenyl)-5-(2,4-disulfophenyl)-2H-tetrazolium, monosodium salt), which produces a water-soluble formazan dye upon bioreduction in the presence of an electron carrier, 1-Methoxy PMS. CCK-8 solution is added directly to the cells, no pre-mixing of components is required. WST-8 is bioreduced by cellular dehydrogenases to an orange formazan product that is soluble in tissue culture medium. The amount of formazan produced is directly proportional to the number of living cells. Since the CCK-8 solution is very stable and it has little cytotoxicity, a longer incubation, such as 24 to 48 hours, is possible.

Cell Counting Kit-8 allows sensitive colorimetric assays for the determination of the number of viable cells in the proliferation and cytotoxicity assays. The detection sensitivity is higher than any other tetrazolium salts such as MTT, XTT or MTS.

**96992-500TESTS-F** 500 test

**96992-3000TESTS-F** 3000 test

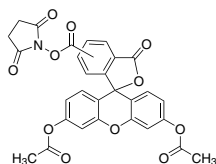
### Live/Dead Cell Double Staining Kit

Staining kit for live/dead cells. The kit contains two staining components for the simultaneous detection of viable and dead cells in cell cultures with a fluorescence microscope.

**04511-1KT-F** 1 kit

## Reagents

### 5(6)-Carboxyfluorescein diacetate *N*-succinimidyl ester



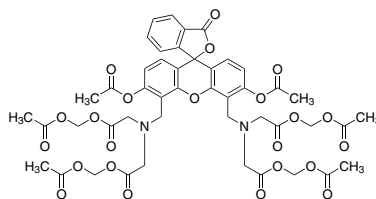
CFSE  
[150347-59-4]  $C_{29}H_{19}NO_{11}$  FW 557.46

Amine-reactive label for long term tracing of cells. Forms green fluorescent conjugates on deacetylation.

**21888-25MG-F** 25 mg

**21888-100MG-F** 100 mg

### Calcein-AM



Calcein *O,O'*-diacetate tetrakis(acetoxymethyl) ester  
[148504-34-1]  $C_{46}H_{46}N_2O_{23}$  FW 994.86

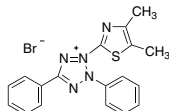
Non-fluorescent cell permeable derivative of calcein, becomes fluorescent on hydrolysis. Used as a neutral substrate for multidrug resistance protein, MRP; employed in tumor research.

Calcein acetoxymethyl ester

**17783-1MG** 1 mg

**17783-5MG** 5 mg

### Thiazolyl Blue Tetrazolium Bromide



MTT; 3-(4,5-Dimethyl-2-thiazolyl)-2,5-diphenyl-2H-tetrazolium bromide; Methylthiazolyl-diphenyl-tetrazolium bromide [298-93-1]  $C_{18}H_{16}BrN_5S$  FW 414.32

**M2128-1G** 1 g

**M2128-5G** 5 g

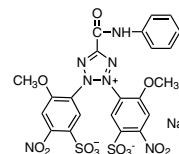
**M2128-10G** 10 g

**M2128-100MG** 100 mg

**M2128-250MG** 250 mg

**M2128-500MG** 500 mg

### XTT sodium salt



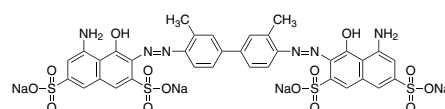
2,3-Bis(2-methoxy-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxanilide inner salt [111072-31-2]

$C_{22}H_{16}N_7NaO_{13}S_2$  FW 673.52

**X4626-100MG** 100 mg

**X4626-500MG** 500 mg

### Trypan Blue solution

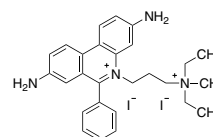


[72-57-1]  $C_{34}H_{24}N_6Na_4O_{14}S_4$  FW 960.81

Use to detect dead and dying cells in cytotoxicity assays and for routine assessment of cell viability. Prepared in 0.81% sodium chloride and 0.06% potassium phosphate, dibasic.

**T8154-20ML** 20 mL

**T8154-100ML** 100 mL



[25535-16-4]  $C_{27}H_{34}N_4$  FW 468.39

**P4864-10ML** 10 mL



Apoptosis

# Apoptosis

Apoptosis is a highly regulated program of cell death that is critical for normal homeostasis, development, wound repair and the removal of pathogen-infected cells. Abnormalities in apoptosis contribute to pathologies in disorders as diverse as Amyotrophic Lateral Sclerosis (ALS), AIDS, cancer, and ischemia. The ability to circumvent the normal induction of apoptosis is often utilized by tumor cells and viruses as a method of increased survival to normal host defenses. Conversely, excessive levels of apoptosis underlie the depletion of T-helper CD4<sup>+</sup> cells during HIV progression and neurons in Parkinson's and Alzheimer's disease.

The molecular mechanisms of apoptosis have been extensively characterized and involve multiple energy-dependent steps which culminate in DNA fragmentation, protein cleavage, alternations in membrane asymmetry, organelle degradation, and the breakdown of the cell into vesicles called apoptotic bodies. At least three major pathways are known to initiate apoptosis, the extrinsic (death receptor) pathway, the intrinsic (mitochondrial) pathway, and the perforin-granzyme pathway. However, the majority of apoptosis-initiating processes converge at the execution pathway initiated by caspase-3 cleavage.

The choice of a kit or reagent depends on multiple parameters including which pathway induces the apoptotic cascade, the type and number of cells used, and the desired method of analysis. Sigma offers a wide variety of kits and reagents for the study of and measurement of apoptosis including assays for caspase activation, DNA fragmentation, loss of mitochondrial

integrity, and the induction of membrane asymmetry. Our collection of products also includes the most complete selection of inhibitors and inducers of apoptosis in the industry.

## Apoptosis Detecting Kits

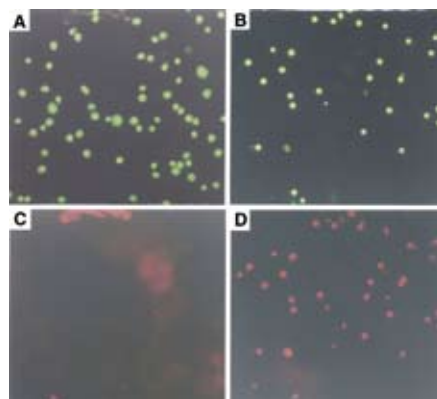
### Flow Cytometry Kit for Apoptosis

Br-dUTP is incorporated more readily into the DNA fragments than deoxyuridine triphosphate labeled with larger dyes such as FITC, biotin or digoxigenin. One of the biological characteristics that defines apoptosis is the degradation of genomic DNA into fragments of 180-200 bp, commonly called "DNA laddering". The fragmentation creates a large number of 3'-hydroxyl sites at the DNA breaks. This property is used in the APO-BRDU kit to identify apoptotic cells by labeling the 3'-hydroxyl sites with bromodeoxyuridine triphosphate (Br-dUTP). Br-dUTP is enzymatically attached to the 3'-hydroxyl sites of double- or single-stranded DNA by terminal transferase (TdT). Non-apoptotic cells do not incorporate Br-dUTP due to the lack of available 3'-hydroxyl sites.

**APOBRDU-1KT** 1 kit

### Annexin V-Cy3 Apoptosis Detection Kit

Sigma's Annexin V-Cy3 kit allows detection of annexin V bound to apoptotic cells by fluorescence microscopy. The Annexin V-Cy3 kit uses the dye Cy3.18 as the fluorochrome conjugated with annexin V. By microscopy, Cy3.18 fluoresces more brightly than the FITC conjugate. The kit includes the non-fluorescent compound 6-carboxyfluorescein diacetate (6-CFDA), which enters the cell and is hydrolyzed by the esterases present in living cells to the fluorescent compound 6-carboxyfluorescein, indicating that the cells are viable. This combination allows the differentiation among early apoptotic cells (annexin V positive, 6-CFDA positive), necrotic cells (annexin V positive, 6-CFDA negative), and viable cells (annexin V negative, 6-CFDA positive).



**Double staining of control cells and apoptotic cells with Annexin V-Cy3 Apoptosis Detection Kit.** Apoptosis was induced in Jurkat cells by 1 µg/ml staurosporine for 2 hours. The cells were washed with PBS and suspended at a concentration of  $0.5 \times 10^6$  cells/ml. The cells were stained with annexin V-Cy3.18 (1 µg/ml) and carboxyfluorescein diacetate (100 µM) in binding buffer for 10 minutes at room temperature. After staining, the cells were washed with binding buffer and observed by fluorescence microscopy. **Figure A:** Non-induced control cells stained with CDFA. **Figure B:** Cells induced with staurosporine and stained with CDFA. **Figure C:** Non-induced control cells from Figure A after annexin V-Cy3.18 staining. Note the absence of apoptotic cells. **Figure D:** Cells induced with staurosporine from Figure B stained with annexin V-Cy3.18. Note that apoptotic cells are stained both with CDFA and annexin V-Cy3.18, while necrotic cells are stained with annexin V-Cy3, but not by CDFA.

**APOAC-1KT** 1 kit

### Annexin V-FITC Apoptosis Detection Kit

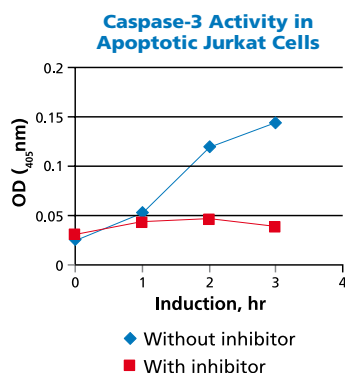
Annexin V-FITC kit allows fluorescent detection of annexin V bound to apoptotic cells and quantitative determination by flow cytometry. The Annexin V-FITC kit uses annexin V conjugated with fluorescein isothiocyanate (FITC) to label phosphatidylserine sites on the membrane surface. The kit includes propidium iodide (PI) to label the cellular DNA in necrotic cells where the cell membrane has been totally compromised. This combination allows the differentiation among early apoptotic cells (annexin V positive, PI negative), necrotic cells (annexin V positive, PI positive), and viable cells (annexin V negative, PI negative).

**APOAF-20TST** 20 test

**APOAF-50TST** 50 test

### Caspase 3 Assay Kit, Colorimetric

Based on the hydrolysis of acetyl-Asp-Glu-Val-Asp p-nitroanilide (Ac-DEVD-pNA) by caspase 3, resulting in the release of the p-nitroaniline (pNA) moiety.



**Caspase 3 activity in apoptotic Jurkat cells.** Apoptosis was induced in Jurkat human cells with 1 µg/ml staurosporine for 0, 1, 2, and 3 hours. The cells were lysed in 1X lysis buffer at a ratio of 100 µl per 10<sup>7</sup> cells. The caspase 3 activity in the lysate was determined using the Caspase 3 Colorimetric Assay Kit (CASP-3-C). Ten µl of each lysate was tested both with and without caspase 3 inhibitor, in a total reaction volume of 100 µl using 96 well multiwell plates. The substrate (Ac-DEVD-pNA) concentration was 200 µM, and the inhibitor (Ac-DEVD-CHO) concentration was 0.05 µM. The assay was performed at pH 7.4 at 37 °C for 42 minutes.

**CASP3C-1KT** 1 kit

### Caspase 3 Assay Kit, Fluorimetric

The Caspase 3 Fluorimetric Assay Kit is based on the hydrolysis of acetyl Asp-Glu-Val-Asp 7-amido-4-methylcoumarin (Ac-DEVD-AMC) by caspase 3, resulting in the release of the fluorescent 7-amino-4-methylcoumarin (AMC).

**CASP3F-1KT** 1 kit

### Caspase 8 Assay Kit, Colorimetric

The Caspase 8 Colorimetric Assay Kit is based on the hydrolysis of the peptide substrate Acetyl-Ile-Glu-Thr-Asp-p-Nitroaniline (Ac-IETD-pNA) by caspase-8 that results in the release of a p-Nitroaniline (p-NA) moiety. The p-NA is read at 405 nm. The concentration of the p-NA released can be calculated from a calibration curve prepared from p-NA standards (included with the kit).

The kit detects caspase 8 activity in crude and purified preparations of caspase 8.

Complete kit contains:

- purified caspase 8 for a positive control
- caspase 8 inhibitor
- p-NA fluorescent standard

**CASP8C-1KT** 1 kit

### Caspase 8 Assay Kit, Fluorimetric

The Caspase 8 Fluorimetric Assay Kit is based on the hydrolysis of the peptide substrate Acetyl-Ile-Glu-Thr-Asp-7-amino-4-methyl coumarin (Ac-IETD-AMC) by caspase-8 that results in the release of a 7-amino-4-methyl coumarin (AMC) moiety. The excitation and emission wavelengths of AMC are 360 nm and 460 nm, respectively. The concentration of the AMC released can be calculated from a calibration curve prepared from AMC standards (included with the kit).

The kit detects caspase 8 activity in crude and purified preparations of caspase 8.

Complete kit contains:

- purified caspase 8 for a positive control
- caspase 8 inhibitor
- AMC fluorescent standard

**CASP8F-1KT** 1 kit

### Cathepsin D Assay Kit

Cathepsin D, a ubiquitous aspartic protease belonging to the A1 peptidase family, is found intracellularly in lysosomes. The enzyme has been associated with various biological processes such as: apoptotic events (e.g., the release of cytochrome c from mitochondria and the loss of the transmembrane potential ( $\Delta\Psi$ ), aging, Alzheimer's disease, and breast cancer.

**CS0800-1KT** 1 kit

## Reagents for Monitoring Mitochondrial Function

### Mitochondria Staining Kit

In normal cells, the JC-1 dye concentrates in the mitochondrial matrix where it forms red fluorescent aggregates. Any event that dissipates the mitochondrial membrane potential (e.g. apoptosis) prevents the accumulation of the JC-1 dye in the mitochondria and thus, the dye is dispersed throughout the entire cell leading to a shift from red (JC-1 aggregates) to green fluorescence (JC-1 monomers). The fluorescence of the cells stained with this kit may be observed by fluorescence microscopy or measured by fluorimetric and flow cytometry analysis.

**CS0390-1KT** 1 kit

### Citrate Synthase Assay Kit

Contains all the required reagents (including a positive control enzyme) for a fast and simple measurement of citrate synthase activity in a whole cell extract or in isolated mitochondria; also enables testing of the intactness of the mitochondrial inner membrane.

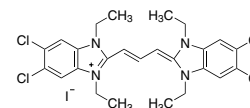
**CS0720-1KT** 1 kit

### Cytochrome c Oxidase Assay Kit

► **soluble and membrane bound mitochondria**  
Cytochrome c oxidase [EC 1.9.3.1] is located on the inner mitochondrial membrane dividing the mitochondrial matrix from the intermembrane space, and has traditionally been used as a marker for this membrane. It is also located in the cytoplasmic membrane of bacteria. Cytochrome c oxidase provides energy for the cell by coupling electron transport through the cytochrome chain with the process of oxidative phosphorylation.

**CYTOCOX1-1KT** 1 kit

### JC-1

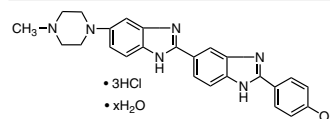


CBIC2(3) [3520-43-2] C<sub>25</sub>H<sub>27</sub>Cl<sub>4</sub>N<sub>4</sub> FW 652.23

**T4069-5MG** 5 mg

## Reagents for Monitoring Apoptosis

### bisBenzimide H 33258

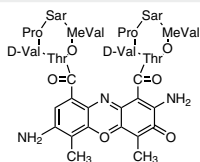


HOE 33258; 2-[2-(4-Hydroxyphenyl)-6-benzimidazolyl]-6-(1-methyl-4-piperazinyl)benzimidazole trihydrochloride; 2'-(4-Hydroxyphenyl)-5-(4-methyl-1-piperazinyl)-2,5'-bi(1H-benzimidazole) trihydrochloride; BBIH; Hoechst 33258 [23491-45-4] C<sub>25</sub>H<sub>24</sub>N<sub>6</sub>O · 3HCl FW 533.88

Membrane-permeable, fluorescent DNA stain with low cytotoxicity that intercalate in A-T regions of DNA.

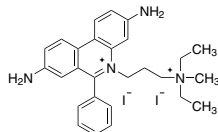
**B1155-25MG** 25 mg

**B1155-100MG** 100 mg

**7-Aminoactinomycin D**7-AAD [7240-37-1]  $C_{62}H_{87}N_{13}O_{16}$  FW 1270.43

Fluorescent DNA stain

|                  |      |
|------------------|------|
| <b>A9400-1MG</b> | 1 mg |
| <b>A9400-5MG</b> | 5 mg |

**Propidium Iodide Solution**[25535-16-4]  $C_{27}H_{34}I_2N_4$  FW 668.39

|                   |       |
|-------------------|-------|
| <b>P4864-10ML</b> | 10 mL |
|-------------------|-------|

**Annexin V Cy3.18 Conjugate from human placenta**

For detection of apoptotic cells by fluorescence microscopy.

|                   |            |
|-------------------|------------|
| <b>A4963-10UG</b> | 10 $\mu$ g |
|-------------------|------------|

**Annexin V FITC Conjugate from human placenta**

For detection of apoptotic cells by flow cytometry or fluorescence microscopy.

Package size based on protein content

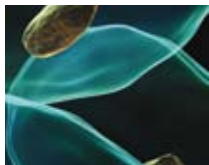
|                   |            |
|-------------------|------------|
| <b>A9210-10UG</b> | 10 $\mu$ g |
|-------------------|------------|

**Apoptosis-Inhibiting Compounds**

| Product Name              | Effective Concentration | Mechanism of Action                                                                                                                                                                                                                             | Cat. No.     |
|---------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| BI-6C9                    | 2 micromolar            | BI-6C9 is a tBid inhibitor and antiapoptotic                                                                                                                                                                                                    | <b>B0186</b> |
| BAX Inhibiting Peptide V5 | ~ 50–200 micromolar     | Interact with Bax in a Ku70 - competitive manner and prevent its conformational change and mitochondrial translocation                                                                                                                          | <b>B1436</b> |
| Bongkreikic acid solution | 10–50 micromolar        | Bongkreikic acid is an inhibitory ligand of the mitochondrial adenine nucleotide translocase. It inhibits mitochondrial permeability transition pore opening.                                                                                   | <b>B6179</b> |
| MDL 28170                 | 20 micromolar           | Selective inhibitor of calpain and cathepsin B                                                                                                                                                                                                  | <b>M6690</b> |
| NSCI                      |                         | A selective inhibitor of nonpeptide caspase 3                                                                                                                                                                                                   | <b>N1413</b> |
| NS3694                    | 50 micromolar           | Specifically prevents the active ~700-kDa apoptosome complex formation triggered by cytochrome c release, thus blocking apoptosome-mediated caspase activation and cell death (50 Mm completely blocks TNF-A-induced death in MCF-casp3 cells). | <b>N7787</b> |
| Pifithrin-M               | 50 micromolar           | Pifithrin-M is an inhibitor of p53 binding and anti-apoptotic                                                                                                                                                                                   | <b>P0122</b> |
| Pifithrin-A               | 0.5–1 micromolar        | Pifithrin-A is a reversible inhibitor of p53-mediated apoptosis                                                                                                                                                                                 | <b>P4359</b> |
| S-15176 difumarate salt   |                         | Inhibits mitochondrial permeability transition, prevents the early step in apoptosis by preventing collapse of the electrochemical gradient across the mitochondrial membrane                                                                   | <b>S5944</b> |

**Apoptosis-Inducing Compounds**

| Product Name                               | Effective Concentration | Mechanism of Action                                                 | Cat. No.     |
|--------------------------------------------|-------------------------|---------------------------------------------------------------------|--------------|
| 2-Amino-N-quinolin-8-yl-benzenesulfonamide | 10–60 micromolar        | Inhibits cell cycle at G2 phase                                     | <b>A3105</b> |
| 17-(Allylamino)-17-demethoxygeldanamycin   | 0.010–10 micromolar     | Inhibits chaperone function of Hsp-90                               | <b>A8476</b> |
| Bendamustine hydrochloride hydrate         |                         | Activates the DNA damage stress response                            | <b>B5437</b> |
| (S)-(+)-Camptothecin                       | 5–25 micrograms/mL      |                                                                     | <b>C9911</b> |
| Etoposide                                  | 25–100 micromolar       | Induces double-stranded DNA damage                                  | <b>E1383</b> |
| Staurosporine from <i>Streptomyces</i> sp. | 0.01 to 10 micromolar   | Mechanism not clear but may be through Protein Kinase C inhibition. | <b>S4400</b> |



Autophagy

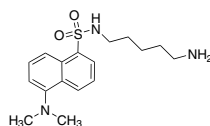
# Autophagy

Autophagy is an evolutionarily conserved degradation process that is required for multiple cellular roles including survival during starvation, the clearance of intracellular components, development, and immunity. Decreases in autophagy occur during aging and may be associated with many age-related pathologies such as dementia and cancer. The vital dyes Acridine Orange and Dansylcadaverine (MDC) are commonly used to study autophagy. Acridine Orange is a lysotropic dye that accumulates in acidic organelles in a pH-dependent manner. At neutral pHs, Acridine Orange is a hydrophobic green fluorescent molecule. Within acidic vesicles, Acridine Orange becomes protonated and trapped within the organelle. Protonated Acridine Orange forms aggregates that emit bright red fluorescence. MDC is another popular autofluorescent marker that preferentially accumulates in autophagic vacuoles. While Acridine Orange staining in lysosomes is primarily due to ion trapping, MDC accumulation in autophagic

vacuoles is due to a combination of ion trapping and specific interactions with vacuole membrane lipids. In addition to these vital dyes, Sigma® Life Science also offers the largest selection of small molecule inhibitors and activators of autophagy and an ever expanding collection of autophagy-related antibodies.

## Reagents For Analyzing Autophagy

### Dansylcadaverine

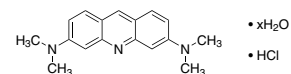


*N*-(Dimethylaminonaphthalenesulfonyl)-1,5-pentanediamine; Monodansyl cadaverine; *N*-(5-Amino-pentyl)-5-dimethylaminonaphthalene-1-sulfonamide  
[10121-91-2]  $C_{17}H_{23}N_3O_2S$  FW 335.46

|                    |        |
|--------------------|--------|
| <b>30432-100MG</b> | 100 mg |
| <b>30432-1G</b>    | 1 g    |

### ▼ Acridine Orange

[65-61-2]  $C_{17}H_{19}N_3 \cdot HCl$  FW 301.81



A rigorously purified zinc-free material suitable for use in flow cytometry.

|                  |     |
|------------------|-----|
| <b>318337-1G</b> | 1 g |
| <b>318337-5G</b> | 5 g |

### Acridine Orange hydrochloride solution

3,6-Bis(dimethylamino)acridine hydrochloride

|                   |       |
|-------------------|-------|
| <b>A8097-10ML</b> | 10 mL |
|-------------------|-------|

### ▲ Acridine Orange

## Autophagy Inhibitors

| Product Name                 | Effective Concentration | Mechanism of Action                                                            | Cat. No.     |
|------------------------------|-------------------------|--------------------------------------------------------------------------------|--------------|
| 3-Methyladenine              | 5 millimolar            | Inhibitor of type III Phosphatidylinositol 3-kinases                           | <b>M9281</b> |
| E64d                         | 1–200 micromolar        | Inhibits lysosomal enzymes, typically used with Pepstatin A and Leupeptin      | <b>E8640</b> |
| Leupeptin                    | 1–100 micromolar        | Inhibits lysosomal enzymes, typically used with E64d and Pepstatin A           | <b>L5793</b> |
| Pepstatin A                  | 1–10 micromolar         | Inhibits lysosomal enzymes, typically used with E64d and Leupeptin             | <b>P5318</b> |
| Bafilomycin A1               | 0.1–1 micromolar        | Inhibitor of vacuolar type H <sup>+</sup> -ATPase (V-ATPase)                   | <b>B1793</b> |
| L-Asparagine                 | 10 millimolar           | Blocks autophagic-lysosomal delivery                                           | <b>A4159</b> |
| LY-294,002                   | 10–100 micromolar       | Phosphatidylinositol 3-kinase inhibitor                                        | <b>L9908</b> |
| Wortmannin                   | 0.1–10 micromolar       | Phosphatidylinositol 3-kinase inhibitor                                        | <b>W1628</b> |
| Chloroquine diphosphate salt | 5–40 micromolar         | Raises lysosomal pH leading to an inhibition of lysosomal autophagosome fusion | <b>C6628</b> |

## Autophagy Activators

| Product Name             | Effective Concentration | Mechanism of Action                               | Cat. No.              |
|--------------------------|-------------------------|---------------------------------------------------|-----------------------|
| Amiodarone Hydrochloride | 10-50 micromolar        | Inhibitor of mTORC1                               | <a href="#">A8423</a> |
| Niclosamide              | 1-10 micromolar         | Inhibitor of mTORC1                               | <a href="#">N3510</a> |
| Rottlerin                | 0.3-3.0 micromolar      | Inhibitor of mTORC1                               | <a href="#">R5648</a> |
| GF 109203X               | 0.02-4 micromolar       | PKC inhibitor                                     | <a href="#">G2911</a> |
| STF-62247                | 0.5-20 micromolar       | Disrupts ER-Golgi trafficking                     | <a href="#">S7448</a> |
| Rapamycin                | 10-500 nanomolar        | Inhibitor of mammalian target of rapamycin (mTOR) | <a href="#">R0395</a> |

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## Antibodies for Detecting Autophagy

| Product Name            | Host                                                | Form                                             | Reacts With                                   | Species Reactivity            | Cat. No.                                                            |
|-------------------------|-----------------------------------------------------|--------------------------------------------------|-----------------------------------------------|-------------------------------|---------------------------------------------------------------------|
| Anti-APG4B              | Anti-APG4B antibody produced in rabbit              | APG4B, human                                     | human                                         | IHC<br>WB                     | <a href="#">AV34434-50UG</a>                                        |
| Anti-ATG10              | Anti-ATG10 antibody produced in rabbit              | ATG10, human                                     | human                                         | IP<br>WB                      | <a href="#">A9356-25UL</a><br><a href="#">A9356-200UL</a>           |
| Anti-ATG13              | Anti-ATG13 antibody produced in rabbit              | KIAA0652, human                                  | human<br>mouse<br>rat                         | WB                            | <a href="#">SAB4200100-200UL</a><br><a href="#">SAB4200100-25UL</a> |
| Anti-Atg14              | Anti-Atg14 antibody produced in rabbit              | KIAA0831, human                                  | human<br>mouse                                | WB<br>WB                      | <a href="#">A6358-25UL</a><br><a href="#">A6358-200UL</a>           |
| Anti-Atg16L             | Anti-Atg16L antibody produced in rabbit             | Atg16L1, mouse<br>Atg16L1, rat<br>ATG16L1, human | human<br>mouse<br>rat                         | WB                            | <a href="#">A7356-25UL</a><br><a href="#">A7356-200UL</a>           |
| Anti-ATG16L1            | Anti-ATG16L1 antibody produced in rabbit            | ATG16L1, human                                   | human                                         | IHC (p)<br>PA<br>WB           | <a href="#">HPA012577-100UL</a>                                     |
| Anti-ATG3               | Anti-ATG3 antibody produced in rabbit               | Atg3, mouse<br>ATG3, human                       | human<br>mouse<br>rat                         | IP<br>WB                      | <a href="#">A3231-25UL</a><br><a href="#">A3231-200UL</a>           |
| Anti-ATG3 (C-terminal)  | Anti-ATG3 (C-terminal) antibody produced in rabbit  | Atg3, mouse<br>ATG3, human                       | human<br>mouse<br>rat                         | IHC (p)<br>IP                 | <a href="#">A3606-25UL</a><br><a href="#">A3606-200UL</a>           |
| Anti-ATG4A              | Anti-ATG4A antibody produced in rabbit              | ATG4A, human                                     | human                                         | IP                            | <a href="#">A3484-25UL</a><br><a href="#">A3484-200UL</a>           |
| Anti-ATG4B              | Anti-ATG4B antibody produced in rabbit              | ATG4B, human<br>Atg4b, rat<br>Atg4b, mouse       | human<br>mouse<br>rat                         | IHC (p)<br>WB<br>WB           | <a href="#">A2981-25UL</a><br><a href="#">A2981-200UL</a>           |
| Anti-ATG4C              | Anti-ATG4C antibody produced in rabbit              | ATG4C, human                                     | human                                         | IHC (p)<br>PA                 | <a href="#">HPA007049-100UL</a>                                     |
| Anti-ATG4C              | Anti-ATG4C antibody produced in rabbit              | ATG4C, human                                     | human                                         | WB                            | <a href="#">A9482-25UL</a><br><a href="#">A9482-200UL</a>           |
| Monoclonal Anti-ATG5    | Monoclonal Anti-ATG5 antibody produced in mouse     | ATG5, human                                      | human                                         | ELISA (i)<br>WB               | <a href="#">WH0009474M1-100UG</a>                                   |
| Anti-ATG5 (C-terminal)  | Anti-ATG5 (C-terminal) antibody produced in rabbit  | Atg5, mouse<br>ATG5, human                       | human<br>mouse                                | WB                            | <a href="#">A0731-25UL</a><br><a href="#">A0731-200UL</a>           |
| Anti-ATG5 (N-terminal)  | Anti-ATG5 (N-terminal) antibody produced in rabbit  | Atg5, rat<br>ATG5, human<br>Atg5, mouse          | human<br>mouse<br>rat                         | WB                            | <a href="#">A0856-25UL</a><br><a href="#">A0856-200UL</a>           |
| Anti-ATG7               | Anti-ATG7 antibody produced in rabbit               | ATG7, human                                      | human                                         | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA007639-100UL</a>                                     |
| Anti-ATG7               | Anti-ATG7 antibody produced in rabbit               | Atg7, rat<br>Atg7, mouse<br>ATG7, human          | human<br>mouse<br>rat                         | IHC (p)<br>IP<br>WB           | <a href="#">A2856-25UL</a><br><a href="#">A2856-200UL</a>           |
| Anti-ATG9 (C-terminal)  | Anti-ATG9 (C-terminal) antibody produced in rabbit  | ATG9A, human<br>Atg9a, rat<br>Atg9a, mouse       | human<br>mouse (predicted)<br>rat (predicted) | WB                            | <a href="#">A0732-25UL</a><br><a href="#">A0732-200UL</a>           |
| Anti-Becn1              | Anti-Becn1 antibody produced in rabbit              | Becn1, rat<br>BECN1, human<br>Becn1, mouse       | human<br>mouse<br>rat                         | IF (i)<br>IHC (p)<br>IP<br>WB | <a href="#">B6186-200UL</a>                                         |
| Anti-Becn1 (N-terminal) | Anti-Becn1 (N-terminal) antibody produced in rabbit | BECN1, human                                     | human                                         | IF (i)<br>IHC (p)<br>IP<br>WB | <a href="#">B6061-25UL</a><br><a href="#">B6061-200UL</a>           |

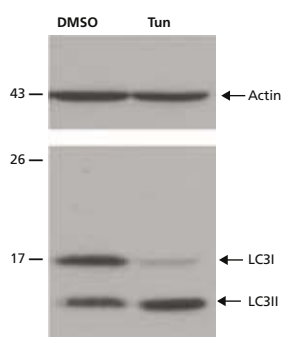
| Product Name          | Host                                              | Form                                                                                                       | Reacts With           | Species Reactivity  | Cat. No.                                                                                |
|-----------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-----------------------------------------------------------------------------------------|
| Anti-LC3              | Anti-LC3 antibody produced in rabbit              | Map1lc3b, mouse<br>MAP1LC3B, human<br>MAP1LC3A, human<br>Map1lc3a, rat<br>Map1lc3b, rat<br>Map1lc3a, mouse | human<br>mouse<br>rat | IP<br>WB            | <a href="#">L8918-25UL</a><br><a href="#">L8918-200UL</a>                               |
| Anti-LC3A             | Anti-LC3A antibody produced in rabbit             | MAP1LC3A, human<br>Map1lc3a, rat<br>Map1lc3a, mouse                                                        | human<br>mouse<br>rat | IP<br>WB            | <a href="#">L8793-25UL</a><br><a href="#">L8793-200UL</a>                               |
| Anti-LC3B             | Anti-LC3B antibody produced in rabbit             | Map1lc3b, rat<br>MAP1LC3B, human<br>Map1lc3b, mouse                                                        | human<br>mouse<br>rat | IF (i)<br>WB        | <a href="#">L7543-25UL</a><br><a href="#">L7543-60UL</a><br><a href="#">L7543-200UL</a> |
| Anti-MAP1LC3A         | Anti-MAP1LC3A antibody produced in rabbit         | MAP1LC3A, human                                                                                            | human                 | WB                  | <a href="#">SAB2101425-50UG</a>                                                         |
| Anti-MAP1LC3A         | Anti-MAP1LC3A antibody produced in rabbit         | MAP1LC3A, human                                                                                            | human                 | IHC (p)<br>PA       | <a href="#">HPA007649-100UL</a>                                                         |
| Anti-p62/SQSTM1       | Anti-p62/SQSTM1 antibody produced in rabbit       | Sqstm1, rat<br>SQSTM1, human<br>Sqstm1, mouse                                                              | human<br>mouse<br>rat | IP<br>WB<br>WB      | <a href="#">P0068-25UL</a><br><a href="#">P0068-200UL</a>                               |
| Anti-PIK3C3 (841-853) | Anti-PIK3C3 (841-853) antibody produced in rabbit | PIK3C3, human                                                                                              | human                 | WB                  | <a href="#">K3141-200UL</a>                                                             |
| Monoclonal Anti-ULK2  | Monoclonal Anti-ULK2 antibody produced in mouse   | ULK2, human                                                                                                | human                 | ELISA (i)<br>WB     | <a href="#">WH0009706M1-100UG</a>                                                       |
| Anti-UVRAG            | Anti-UVRAG antibody produced in rabbit            | UVRAG, human                                                                                               | human                 | IHC (p)<br>PA<br>WB | <a href="#">HPA016932-100UL</a>                                                         |
| Anti-UVRAG            | Anti-UVRAG antibody produced in rabbit            | UVRAG, human<br>Uvrage, mouse                                                                              | human<br>mouse        | WB                  | <a href="#">U7508-25UL</a><br><a href="#">U7508-200UL</a>                               |
| Monoclonal Anti-UVRAG | Monoclonal Anti-UVRAG antibody produced in mouse  | Uvrage, mouse<br>UVRAG, human                                                                              | human<br>mouse        | IP<br>WB            | <a href="#">SAB4200005-25UL</a><br><a href="#">SAB4200005-200UL</a>                     |
| Anti-VPS34            | Anti-VPS34 antibody produced in rabbit            | PIK3C3, human<br>Pik3c3, mouse<br>Pik3c3, rat                                                              | human<br>mouse<br>rat | IF (i)<br>WB        | <a href="#">V9764-25UL</a><br><a href="#">V9764-200UL</a>                               |
| Anti-VPS4             | Anti-VPS4 antibody produced in rabbit             | Vps4a, mouse<br>VPS4A, human<br>Vps4a, rat                                                                 | human<br>mouse<br>rat | IP<br>WB            | <a href="#">SAB4200025-25UL</a><br><a href="#">SAB4200025-200UL</a>                     |
| Anti-VPS4A            | Anti-VPS4A antibody produced in rabbit            | VPS4A, human<br>Vps4a, mouse<br>Vps4a, rat                                                                 | human<br>rat          | IP<br>WB            | <a href="#">SAB4200022-25UL</a><br><a href="#">SAB4200022-200UL</a>                     |
| Anti-VPS4B            | Anti-VPS4B antibody produced in rabbit            | VPS4B, human                                                                                               | human<br>mouse        | IP<br>WB            | <a href="#">SAB4200023-25UL</a><br><a href="#">SAB4200023-200UL</a>                     |
| Anti-WIP1             | Anti-WIP1 antibody produced in rabbit             | WIP1, human                                                                                                | human                 | IHC (p)<br>PA<br>WB | <a href="#">HPA007493-100UL</a>                                                         |
| Monoclonal Anti-WIP1  | Monoclonal Anti-WIP1 antibody produced in mouse   | WIP1, human                                                                                                | human<br>mouse<br>rat | ELISA (i)<br>WB     | <a href="#">WH0055062M2-100UG</a>                                                       |

## Antibodies For Detecting Autophagy

### Immunoblotting

Whole extracts of human HEK-293T cells (Lane A) or HEK-293T cells pre-treated with tunicamycin for 48 h (Lane B) were separated on SDS-PAGE and blotted.

Upper panel: Anti-Actin (**Cat. No. A3853**). Lower panel: 0.5 µg/mL Rabbit Anti-LC3B (**Cat. No. L7543**). The antibody was developed with Goat Anti-Rabbit IgG, Peroxidase conjugate and a chemiluminescent substrate.





## Reactive Oxygen Species

# Reactive Oxygen Species

## Oxidative Stress Enzymes

| Name                                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Cat No.                                                            |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Catalase from bovine liver                                  | Activates the decomposition of hydrogen peroxide, Natural antioxidant used to study roles of reactive oxygen species in gene expression and apoptosis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | C100-50MG<br>C100-500MG<br>C100-1G                                 |
| Cytochrome c Oxidase from bovine heart                      | Cytochrome c oxidase is the principal terminal oxidase of high oxygen affinity in the aerobic metabolism of all animals, plants, yeasts and some bacteria.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | C5499-250UG                                                        |
| Glutathione Peroxidase from bovine erythrocytes             | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | G6137-100UN<br>G6137-200UN<br>G6137-500UN                          |
| Myeloperoxidase from human leukocytes                       | Catalyzes oxidations by hydrogen peroxide, including cytotoxic actions on bacteria, fungi, and tumor cells. Also catalyzes cross-linking of immune complexes and inactivates chemotactic factors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | M6908-SUN                                                          |
| Methionine Sulfoxide Reductase A, histidine-tagged human    | MsrA reduces S-MetO and MsrB reduces R-MetO, which may prevent irreversible oxidative protein damage and thus extend an organism's life span. There is evidence showing a connection between MsrA and Alzheimer's disease.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | M8698-100UG                                                        |
| Nitrate Reductase (cytochrome) from <i>Escherichia coli</i> | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N0519-SUN                                                          |
| Peroxidase from horseradish                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | P6782-5MG<br>P6782-10MG<br>P6782-25MG<br>P6782-50MG<br>P6782-100MG |
| Peroxioredoxin 1 human                                      | Peroxioredoxins are a novel defined family of peroxidases of approximately 25 kDa that reduce H <sub>2</sub> O <sub>2</sub> and alkyl hydroperoxides and use mainly the thioredoxin (Trx) system (Trx, thioredoxin reductase and NADPH) as electron donor. The peroxiredoxin family includes more than 30 proteins from organisms of all kingdoms. Peroxioredoxin I belongs to the Type I Peroxioredoxin family. This family consists of human natural killer cell enhancing factor (NKEFA), human proliferation associated gene (PAG), mouse macrophage stress induced protein (MSP23), mouse osteoblast specific factor (OSF-3), and rat heme-binding protein (HBP23). These proteins share about 95% homology. | P8986-250UG                                                        |
| Superoxide Dismutase from bovine erythrocytes               | Catalyzes the dismutation of superoxide radicals to hydrogen peroxide and molecular oxygen. Plays a critical role in the defense of cells against the toxic effects of oxygen radicals. Competes with nitric oxide (NO) for superoxide anion (which reacts with NO to form peroxynitrite), thereby SOD promotes the activity of NO. SOD has also been shown to suppress apoptosis in cultured rat ovarian follicles, neural cell lines, and transgenic mice.                                                                                                                                                                                                                                                      | S7571-15KU<br>S7571-30KU<br>S7571-75KU<br>S7571-300KU              |
| Superoxide Dismutase from human erythrocytes                | Catalyzes the dismutation of superoxide radicals to hydrogen peroxide and molecular oxygen. Plays a critical role in the defense of cells against the toxic effects of oxygen radicals. Competes with nitric oxide (NO) for superoxide anion (which reacts with NO to form peroxynitrite), thereby SOD promotes the activity of NO. SOD has also been shown to suppress apoptosis in cultured rat ovarian follicles, neural cell lines, and transgenic mice.                                                                                                                                                                                                                                                      | S9636-1KU<br>S9636-3KU<br>S9636-15KU<br>S9636-30KU                 |
| Thioredoxin Reductase from <i>Escherichia coli</i>          | Thioredoxin reductase (TrxR) is an NADPH-dependent oxidoreductase containing one FAD per subunit that reduces the active site disulfide in oxidized thioredoxin (Trx). The molecular weight of the isozymes from mammalian sources vary between 55-67 kDa as compared with 35 kDa in prokaryotes, plants or yeast. The substrate specificity of the mammalian enzyme is much broader than the prokaryotic enzyme reducing both mammalian and <i>E. coli</i> thioredoxins as well as non-disulfide substrates such as selenite, lipoic acids, lipid hydroperoxides and hydrogen peroxide. FAD-containing enzyme involved in transfer of hydrogen from <i>E. coli</i> thioredoxin to other proteins.                | T7915-250UG                                                        |
| Thioredoxin Reductase from rat liver                        | Thioredoxin reductase (TrxR) is a NADPH-dependent oxidoreductase containing one FAD per subunit that reduces the active site disulfide in oxidized thioredoxin (Trx).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | T9698-50UG                                                         |

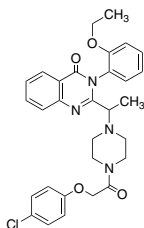
## Kits For ROS Analysis

| Name                                                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Cat. No.    | Qty   |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|
| Catalase Assay Kit, determination of catalase activity in tissues and cells | Catalase is a ubiquitous antioxidant enzyme which catalyses the decomposition of hydrogen peroxide ( $H_2O_2$ ) to water and oxygen. Hydrogen peroxide is formed in the eukaryotic cell as a by-product of various oxidases and superoxide dismutases. Hydrogen peroxide accumulation in cells causes oxidation of cellular targets such as DNA, proteins, and lipids leading to mutagenesis and cell death. Removal of the $H_2O_2$ from the cell by catalase provides protection against oxidative damage to living cells and its role in oxidative stress related diseases has been widely studied.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CAT100-1KT  | 1 kit |
| Thioredoxin Reductase Assay Kit                                             | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CS0170-1KT  | 1 kit |
| Glutathione Assay Kit                                                       | Reduced glutathione (GSH), a tripeptide (g-glutamyl-cysteinylglycine), is the major free thiol in most living cells and is involved in many biological processes such as detoxification of xenobiotics, removal of hydroperoxides, and maintenance of the oxidation state of protein sulfhydryls. It is the key antioxidant in animal tissues. Reduced glutathione (GSH), a tripeptide (g-glutamyl-cysteinylglycine), is the major free thiol in most living cells and is involved in detoxification of xenobiotics, removal of hydroperoxides, and maintenance of the oxidation state.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | CS0260-1KT  | 1 kit |
| Antioxidant Assay Kit                                                       | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CS0790-1KT  | 1 kit |
| Superoxide Anion Assay Kit                                                  | The superoxide anion ( $O_2^-$ ) is a short-lived radical generated by the addition of an electron to oxygen. It is formed in response to environmental factors such as UV light, cigarette smoke, environmental pollutants, and $\gamma$ -radiation, or by oxidases like xanthine oxidase or NADPH oxidase. Once formed, $O_2^-$ attacks cellular components causing damage to lipids, proteins, and DNA. This can initiate numerous diseases, including cancer, atherosclerosis, rheumatoid arthritis, diabetes, liver damage, and central nervous system disorders.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CS1000-1KT  | 1 kit |
| Glutathione Assay Kit, Fluorimetric                                         | Reduced glutathione (GSH), a tripeptide ( $\gamma$ -glutamyl-cysteinylglycine), is the major free thiol in most living cells and is involved in many biological processes such as detoxification of xenobiotics, removal of hydroperoxides, and maintenance of the oxidation state of protein sulfhydryls. It is the key antioxidant in animal tissues. Glutathione is present inside cells primarily in the reduced form (90-95% of the total glutathione). The remainder is present in the oxidized form (glutathione disulfide, GSSG). Intracellular GSH status appears to be a sensitive indicator of the overall health of a cell and its ability to resist toxic challenge. High levels of GSH in the cell may indicate pathological changes. Reduced glutathione (GSH), a tripeptide ( $\gamma$ -glutamyl-cysteinylglycine), is the major free thiol in most living cells and is involved in many biological processes such as detoxification of xenobiotics, removal of hydroperoxides, and maintenance of the oxidation state of protein sulfhydryls. It is the key antioxidant in animal tissues.                                                                                                                                                                                                                                                                                                                   | CS1020-1KT  | 1 kit |
| Nitric Oxide Synthase Detection System, Fluorimetric                        | Simple and specific assay for the measurement of free nitric oxide (NO) and nitric oxide synthase (NOS) activity in living cells under physiological conditions. Nitric oxide, formed from the amino acid L-arginine via the action of NOS, is a unique cell signaling molecule that functions as both an intracellular and an extracellular messenger. NO has been implicated in vasodilation, neurotransmission, cytotoxicity, and inflammation.<br><br>The standard assay for NOS activity is for solubilized cell-free enzyme preparations such as cell lysates, crude tissue extracts or purified enzymes. It measures the production of radiolabeled citrulline from radiolabeled arginine substrate (Sigma Product No. NOS-1). In contrast, the Fluorometric Cell-Associated NOS Detection System measures intracellular production of NO by a non-radiometric method. Radioisotopes are replaced by a cell-permeable diacetate derivative of 4,5-diaminofluorescein (DAF-2 DA). DAF-2 DA penetrates cells rapidly where it is hydrolyzed by intracellular esterase to DAF-2 that, in turn, reacts with NO produced by NOS to form a fluorescent triazolo-fluorescein. The fluorescent product can be quantitated using an excitation filter at 492 nm and an emission filter at 515 nm.                                                                                                                               | FCANOS1-1KT | 1 kit |
| Glutathione Reductase Assay Kit                                             | Glutathione reductase (EC 1.6.4.2) (GR) is a ubiquitous enzyme that catalyzes the reduction of oxidized glutathione (GSSG) to glutathione (GSH). Glutathione reductase is essential for the glutathione redox cycle that maintains adequate levels of reduced cellular GSH, which serves as an antioxidant reacting with free radicals and organic peroxides. Glutathione is also a substrate for the glutathione peroxidases and glutathione S-transferases in the detoxification of organic peroxides and the metabolism of xenobiotics. This kit contains reagents for the spectrophotometric determination of glutathione reductase activity either by following the decrease in absorbance caused by the oxidation of NADPH at 340 nm (UV assay) or the increase in absorption caused by the reduction of dithiobis(2-nitrobenzoic acid) (DTNB) at 412 nm (colorimetric assay). This kit provides reagents for a spectrophotometric assay for measuring the activity of glutathione reductase either by following the decrease in $A_{340}$ caused by the oxidation of NADPH or the increase in $A_{412}$ caused by the reduction of dithiobis(2-nitrobenzoic acid). Spectrophotometric assay for measuring the activity of glutathione reductase either by following the decrease in $A_{340}$ caused by the oxidation of NADPH or the increase in $A_{412}$ caused by the reduction of dithiobis(2-nitrobenzoic acid). | GRSA-1KT    | 1 kit |

## Reagents

### Erastin

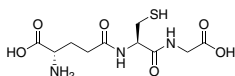
2-[1-[4-[2-(4-Chlorophenoxy)acetyl]-1-piperazinyl]ethyl]-3-(2-ethoxyphenyl)-4(3H)-Quinazolinone [571203-78-6]  $C_{30}H_{31}ClN_4O_4$   
FW 547.04



|                  |      |
|------------------|------|
| <b>E7781-1MG</b> | 1 mg |
| <b>E7781-5MG</b> | 5 mg |

### L-Glutathione reduced

γ-L-Glutamyl-L-cysteinyl-glycine;  
GSH γ-Glu-Cys-Gly  
[70-18-8]  $H_2NCH(CO_2H)CH_2CH_2CONHCH(CH_2SH)CONHCH_2CO_2H$   
FW 307.32

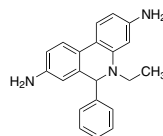


Endogenous antioxidant that plays a major role in reducing reactive oxygen species formed during cellular metabolism and the respiratory burst. Glutathione-S-transferase catalyzes the formation of glutathione thioethers with xenobiotics, leukotrienes, and other molecules that have an electrophilic center. Glutathione also forms disulfide bonds with cysteine residues in proteins. Via these mechanisms, it can have the paradoxical effect of reducing the efficacy of anti-cancer agents.

|                    |        |
|--------------------|--------|
| <b>G4251-10MG</b>  | 10 mg  |
| <b>G4251-300MG</b> | 300 mg |
| <b>G4251-1G</b>    | 1 g    |
| <b>G4251-5G</b>    | 5 g    |
| <b>G4251-10G</b>   | 10 g   |
| <b>G4251-25G</b>   | 25 g   |
| <b>G4251-50G</b>   | 50 g   |
| <b>G4251-100G</b>  | 100 g  |
| <b>G4251-250G</b>  | 250 g  |
| <b>G4251-500G</b>  | 500 g  |

### Dihydroethidium

2,7-Diamino-10-ethyl-9-phenyl-9,10-dihydrophenanthridine;  
3,8-Diamino-5,6-dihydro-5-ethyl-6-phenylphenanthridine; Hydroethidine [104821-25-2]  $C_{21}H_{21}N_3$   
FW 315.41



Redox indicator. Blue fluorescence until oxidized to ethidium.<sup>1</sup>

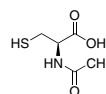
**Lit cited:** 1. Vytautas, P., *J. Neurosci.* **16**, 1324 (1996)

Packaged under Argon.

|                   |       |
|-------------------|-------|
| <b>D7008-10MG</b> | 10 mg |
|-------------------|-------|

### N-Acetyl-L-cysteine

NAC; LNAC [616-91-1]  
 $HSCH_2CH(NHCOCH_3)CO_2H$  FW 163.19



Antioxidant and mucolytic agent. Increases cellular pools of free radical scavengers. Reported to prevent apoptosis in neuronal cells but induce apoptosis in smooth muscle cells. Inhibits HIV replication. May serve as a substrate for microsomal glutathione transferase.

|                   |       |
|-------------------|-------|
| <b>A9165-5G</b>   | 5 g   |
| <b>A9165-25G</b>  | 25 g  |
| <b>A9165-100G</b> | 100 g |

### 2,3-Dimethoxy-1,4-naphthoquinone

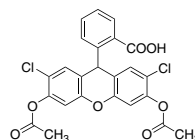
DMNQ [6956-96-3]  $C_{12}H_8O_4$  FW 218.21

Used to study the role of ROS in cell toxicity, apoptosis, and necrosis.

|                   |       |
|-------------------|-------|
| <b>D5439-5MG</b>  | 5 mg  |
| <b>D5439-25MG</b> | 25 mg |

### 2',7'-Dichlorofluorescein diacetate

2',7'-Dichlorodihydrofluorescein diacetate [4091-99-0]  
 $C_{24}H_{16}Cl_2O_7$  FW 487.29



A cell-permeable non-fluorescent probe. It is de-esterified intracellularly and turns to highly fluorescent 2',7'-dichlorofluorescein upon oxidation.

Applications: sensitive and rapid quantitation of oxygen-reactive species in response to oxidative metabolism; microplate assay for detecting oxidative products in phagocytic cells, and quantitative multiwell myeloid differentiation assay.

|                    |        |
|--------------------|--------|
| <b>D6883-50MG</b>  | 50 mg  |
| <b>D6883-250MG</b> | 250 mg |

### Hydrogen peroxide solution

[7722-84-1]  $H_2O_2$  FW 34.01  $H_2O_2$

▶ contains stabilizer

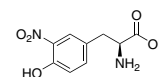
Used to prepare solutions for induction of apoptosis. ~60% of HL60 cells were apoptotic after exposure to 15  $\mu M$   $H_2O_2$  for 8 hr.<sup>1</sup>

**Lit cited:** 1. Lennon, S.V., et al., Dose-dependent induction of apoptosis in human tumour cell lines by widely diverging stimuli. *Cell Prolif.* **24**, 203-214 (1991)

|                    |        |
|--------------------|--------|
| <b>H1009-5ML</b>   | 5 mL   |
| <b>H1009-100ML</b> | 100 mL |
| <b>H1009-500ML</b> | 500 mL |

### 3-Nitro-L-tyrosine

[621-44-3]  $O_2NC_6H_3(OH)CH_2CH(NH_2)CO_2H$  FW 226.19



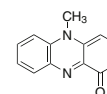
Oxidant and cytotoxic agent.

Marker for peroxynitrite.

|                  |      |
|------------------|------|
| <b>N7389-5G</b>  | 5 g  |
| <b>N7389-10G</b> | 10 g |
| <b>N7389-25G</b> | 25 g |

### Pyocyanin

Pyocyanine; 5-Methyl-1(5H)-phenazinone; Sanazin; Sanasin  
 $C_{15}H_{10}N_2O$  FW 210.23



|                   |       |
|-------------------|-------|
| <b>P0046-5MG</b>  | 5 mg  |
| <b>P0046-25MG</b> | 25 mg |



## LOPAC® Library of Bioactive Small Molecules

# LOPAC® Library of Bioactive Small Molecules

Drug Discovery and pathway analysis are made easy with the power of Sigma's Library of Pharmacologically Active Compounds (LOPAC). This annotated collection of small molecule modulators and approved drugs impacts most cellular processes and covers all major drug target classes.

Relevant Compounds and Pharmacological Activities

- Antiproliferatives
- Enzyme inhibitors
- Antibiotics

- Cell cycle regulators
- Apoptosis inducers
- GPCR ligands

LOPAC® compounds are also indexed in the NCBI's PubChem database. To browse the compounds on the LOPAC<sup>1280</sup> Navigator or request a complete list of components, please visit [sigma.com/LOPAC](http://sigma.com/LOPAC). The power and convenience of the known actives in Sigma's Library of Pharmacologically Active Compounds is assured.

| Name                                                        | Cat. No.                   |
|-------------------------------------------------------------|----------------------------|
| LOPAC <sup>®1280</sup> -International Version               | <a href="#">LO3300-1KT</a> |
| LOPAC <sup>®1280</sup> - Small Scale                        | <a href="#">LO4100-1EA</a> |
| LOPAC <sup>®1280</sup> - Small Scale, International Version | <a href="#">LO4200-1EA</a> |
| LOPAC <sup>®1280</sup>                                      | <a href="#">LO1280-1KT</a> |

## Free Biological Detergents Poster

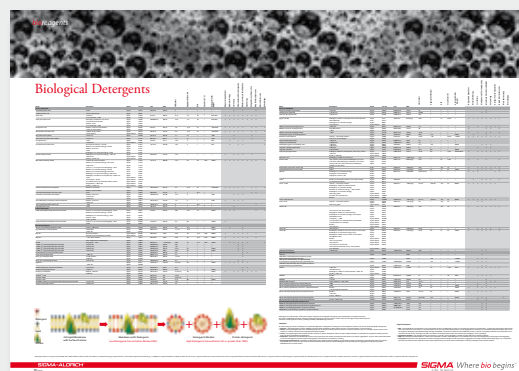
Complete overview of over 180 Detergents

### Organized by:

The nature of the hydrophilic head group

### Includes information on:

- Recommended Application
- Quality
- Molecular weight
- CMC (critical micellar concentration)
- Aggregation number
- HLB (hydrophile-lipophile balance)
- Cloud point



Don't see the Detergent you are looking for? Go to our online product catalog for additional information on over 500 Detergents.

To order the Biological Detergents poster go to [sigma-aldrich.com/detergents](http://sigma-aldrich.com/detergents).



## Cell and Organelle Labeling

# Cell and Organelle Labeling

## Prestige Antibodies® powered by Atlas Antibodies for Organelle Labeling

The Human Protein Atlas Program has carefully selected three different human cell lines, A-431 epidermoid carcinoma, U-251 MG glioblastoma and U-205 osteosarcoma, for organelle mapping of the proteome. As Prestige Antibodies are studied by

immunofluorescence (IF) staining, three well-characterized organelle markers for nuclei, microtubules and endoplasmic reticulum are used correspondingly as specific probes. The high-resolution confocal images are annotated based on sub-cellular localization. In addition, staining intensity and characteristics are also part of an overall assessment as well as comparison to literature (if available). All these factors

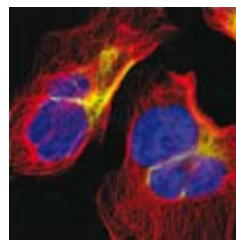
contribute to a final reliability score publicly available on line. Among the Prestige Antibodies tested in immunofluorescence (IF), a set of specific antibodies is classified as organelle markers. These probes have been subjected to the well-established quality control by the HPA program, and are thus very well suited for sub-cellular localization studies by immunofluorescence (IF.)

**Prestige Antibodies®**

Powered by **ATLAS**  
ANTIBODIES

### Cytoskeleton-Intermediate Filaments

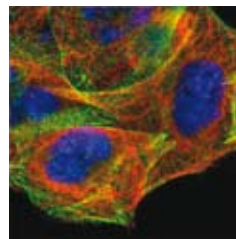
| Product Name | Host                                 | Form       | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|--------------------------------------|------------|-------------|-------------------------------|---------------------------------|
| Anti-VIM     | Anti-VIM antibody produced in rabbit | VIM, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001762-100UL</a> |
| Anti-NES     | Anti-NES antibody produced in rabbit | NES, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA007007-100UL</a> |



**Immunofluorescence**  
Anti-NES:  
**Cat. No. HPA007007:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in cytoskeleton.

### Cytoskeleton-Actin Filaments

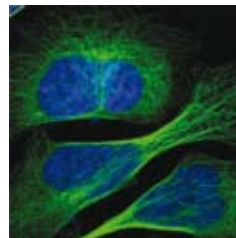
| Product Name | Host                                   | Form         | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|----------------------------------------|--------------|-------------|-------------------------------|---------------------------------|
| Anti-FLNA    | Anti-FLNA antibody produced in rabbit  | FLNA, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA002925-100UL</a> |
| Anti-ACTN1   | Anti-ACTN1 antibody produced in rabbit | ACTN1, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA006035-100UL</a> |



**Immunofluorescence**  
Anti-ACTN1:  
**Cat. No. HPA006035:**  
Immunofluorescent staining of human cell line A-431 shows positivity in cytoskeleton.

### Cytoskeleton-Microtubules

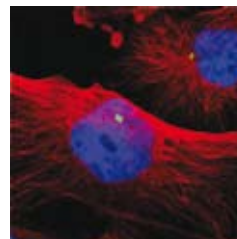
| Product Name | Host                                     | Form           | Reacts With | Species Reactivity  | Cat. No.                        |
|--------------|------------------------------------------|----------------|-------------|---------------------|---------------------------------|
| Anti-TGFB111 | Anti-TGFB111 antibody produced in rabbit | TGFB111, human | human       | IHC (p)<br>PA<br>WB | <a href="#">HPA006376-100UL</a> |



**Immunofluorescence**  
Anti-TGFB111:  
**Cat. No. HPA006376:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in cytoskeleton.

## Centrosomes

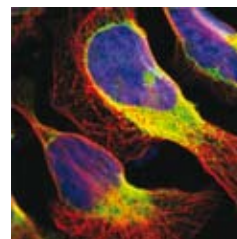
| Product Name | Host                                   | Form         | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|----------------------------------------|--------------|-------------|-------------------------------|---------------------------------|
| Anti-DNAL4   | Anti-DNAL4 antibody produced in rabbit | DNAL4, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA003647-100UL</a> |



**Immunofluorescence**  
Anti-DNAL4:  
**Cat. No. HPA003647:**  
Immunofluorescent staining of human cell line U-251MG shows positivity in centrosome.

## Endoplasmic Reticulum

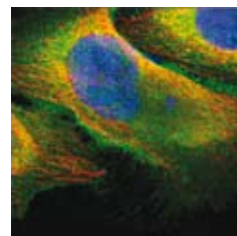
| Product Name | Host                                    | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|-----------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-KTN1    | Anti-KTN1 antibody produced in rabbit   | KTN1, human   | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA003178-100UL</a> |
| Anti-PDIA3   | Anti-PDIA3 antibody produced in rabbit  | PDIA3, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA003230-100UL</a> |
| Anti-BCAP31  | Anti-BCAP31 antibody produced in rabbit | BCAP31, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA003906-100UL</a> |



**Immunofluorescence**  
Anti-PDIA3:  
**Cat. No. HPA003230:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in endoplasmic reticulum.

## Plasma Membrane

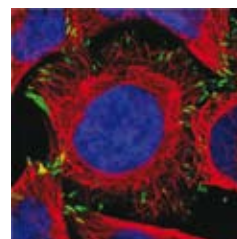
| Product Name  | Host                                      | Form            | Reacts With | Species Reactivity            | Cat. No.                        |
|---------------|-------------------------------------------|-----------------|-------------|-------------------------------|---------------------------------|
| Anti-SLC9A3R2 | Anti-SLC9A3R2 antibody produced in rabbit | SLC9A3R2, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001672-100UL</a> |
| Anti-NF2      | Anti-NF2 antibody produced in rabbit      | NF2, human      | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA003097-100UL</a> |



**Immunofluorescence**  
Anti-NF2:  
**Cat. No. HPA003097:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in cytoplasm & plasma membrane.

## Focal Adhesions

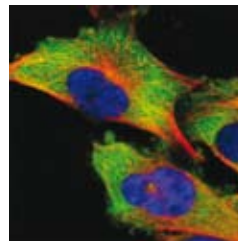
| Product Name | Host                                  | Form                       | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|---------------------------------------|----------------------------|-------------|-------------------------------|---------------------------------|
| Anti-MYH6    | Anti-MYH6 antibody produced in rabbit | MYH7, human<br>MYH6, human | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA001349-100UL</a> |
| Anti-ZYX     | Anti-ZYX antibody produced in rabbit  | ZYX, human                 | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA004835-100UL</a> |
| Anti-VASP    | Anti-VASP antibody produced in rabbit | VASP, human                | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA005724-100UL</a> |



**Immunofluorescence**  
Anti-ZYX:  
**Cat. No. HPA004835:**  
Immunofluorescent staining of human cell line A-431 shows positivity in focal adhesions.

## Cytoplasm

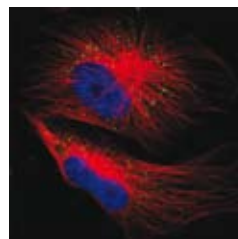
| Product Name | Host                                    | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|-----------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-MTHFD1  | Anti-MTHFD1 antibody produced in rabbit | MTHFD1, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001290-100UL</a> |
| Anti-DDX3X   | Anti-DDX3X antibody produced in rabbit  | DDX3X, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001648-100UL</a> |
| Anti-USP10   | Anti-USP10 antibody produced in rabbit  | USP10, human  | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA006731-100UL</a> |



**Immunofluorescence**  
Anti-DDX3X:  
**Cat. No. HPA001648:**  
Immunofluorescent staining of human cell line U-251MG shows positivity in cytoplasm.

## Peroxisomes

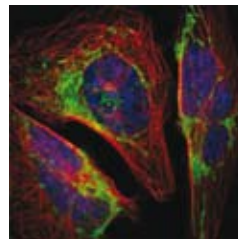
| Product Name | Host                                   | Form         | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|----------------------------------------|--------------|-------------|-------------------------------|---------------------------------|
| Anti-ACAA1   | Anti-ACAA1 antibody produced in rabbit | ACAA1, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA007244-100UL</a> |



**Immunofluorescence**  
Anti-ACAA1:  
**Cat. No. HPA007244:**  
Immunofluorescent staining of human cell line U-251MG shows positivity in peroxisomes.

## Mitochondria

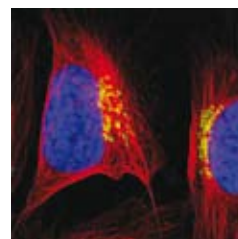
| Product Name | Host                                     | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|------------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-SYNJ2BP | Anti-SYNJ2BP antibody produced in rabbit | COX16, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA000866-100UL</a> |
| Anti-HSPA9   | Anti-HSPA9 antibody produced in rabbit   | HSPA9, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA000898-100UL</a> |
| Anti-TIMM9   | Anti-TIMM9 antibody produced in rabbit   | TIMM9, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA002932-100UL</a> |
| Anti-MRPL40  | Anti-MRPL40 antibody produced in rabbit  | MRPL40, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA006181-100UL</a> |



**Immunofluorescence**  
Anti-HSPA9:  
**Cat. No. HPA000898:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in mitochondria.

## Golgi

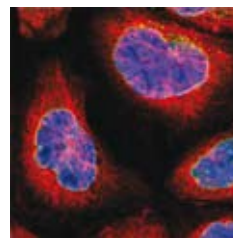
| Product Name | Host                                    | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|-----------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-GOLGA5  | Anti-GOLGA5 antibody produced in rabbit | GOLGA5, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA000992-100UL</a> |
| Anti-GOLIM4  | Anti-GOLIM4 antibody produced in rabbit | GOLIM4, human | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA001677-100UL</a> |



**Immunofluorescence**  
Anti-GOLIM4:  
**Cat. No. HPA001677:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in golgi.

## Nuclear Envelope

| Product Name | Host                                    | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|-----------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-UNC84B  | Anti-UNC84B antibody produced in rabbit | UNC84B, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001209-100UL</a> |
| Anti-UNC84A  | Anti-UNC84A antibody produced in rabbit | UNC84A, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA008461-100UL</a> |



### Immunofluorescence

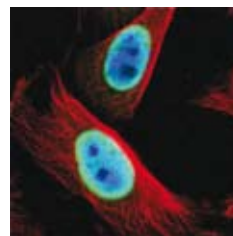
Anti-UNC84A:

**Cat. No. HPA008461:**

Immunofluorescent staining of human cell line A-431 shows positivity in nuclear membrane & vesicles.

## Nucleus without Nucleoli

| Product Name | Host                                   | Form         | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|----------------------------------------|--------------|-------------|-------------------------------|---------------------------------|
| Anti-AKAP8   | Anti-AKAP8 antibody produced in rabbit | AKAP8, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA004776-100UL</a> |
| Anti-FUBP1   | Anti-FUBP1 antibody produced in rabbit | FUBP1, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA006149-100UL</a> |
| Anti-FUS     | Anti-FUS antibody produced in rabbit   | FUS, human   | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA008784-100UL</a> |



### Immunofluorescence

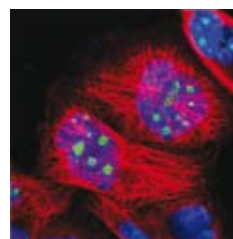
Anti-FUS:

**Cat. No. HPA008784:**

Immunofluorescent staining of human cell line U-251MG shows positivity in nuclei but not nucleoli.

## Nucleoli

| Product Name | Host                                    | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|-----------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-VSX2    | Anti-VSX2 antibody produced in rabbit   | VSX2, human   | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA003436-100UL</a> |
| Anti-ZSCAN1  | Anti-ZSCAN1 antibody produced in rabbit | ZSCAN1, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA007938-100UL</a> |



### Immunofluorescence

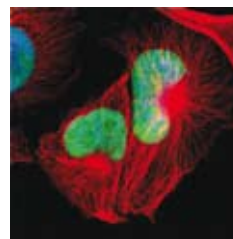
Anti-VSX2:

**Cat. No. HPA003436:**

Immunofluorescent staining of human cell line A-431 shows positivity in nucleoli.

## Nucleus

| Product Name | Host                                    | Form          | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|-----------------------------------------|---------------|-------------|-------------------------------|---------------------------------|
| Anti-MECP2   | Anti-MECP2 antibody produced in rabbit  | MECP2, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA000593-100UL</a> |
| Anti-GPKOW   | Anti-GPKOW antibody produced in rabbit  | GPKOW, human  | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001894-100UL</a> |
| Anti-FBXO18  | Anti-FBXO18 antibody produced in rabbit | FBXO18, human | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA002844-100UL</a> |
| Anti-MYST4   | Anti-MYST4 antibody produced in rabbit  | MYST4, human  | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA006104-100UL</a> |
| Anti-XRCC4   | Anti-XRCC4 antibody produced in rabbit  | XRCC4, human  | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA006801-100UL</a> |



### Immunofluorescence

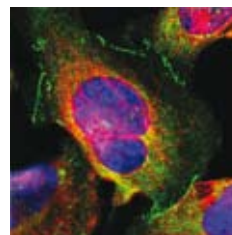
Anti-FBXO18:

**Cat. No. HPA002844:**

Immunofluorescent staining of human cell line U-251MG shows positivity in nuclei.

## Intracellular Junctions

| Product Name | Host                                  | Form        | Reacts With | Species Reactivity            | Cat. No.                        |
|--------------|---------------------------------------|-------------|-------------|-------------------------------|---------------------------------|
| Anti-TJP1    | Anti-TJP1 antibody produced in rabbit | TJP1, human | human       | IF (i)<br>IHC (p)<br>PA       | <a href="#">HPA001636-100UL</a> |
| Anti-TJP2    | Anti-TJP2 antibody produced in rabbit | TJP2, human | human       | IF (i)<br>IHC (p)<br>PA<br>WB | <a href="#">HPA001813-100UL</a> |

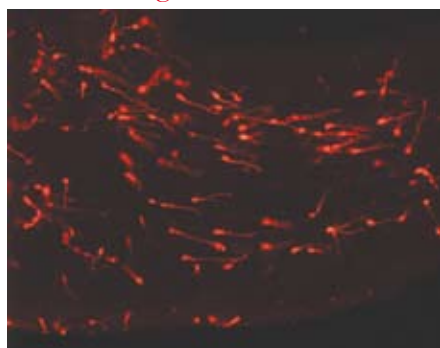


**Immunofluorescence**  
Anti-TJP1:  
**Cat. No. HPA001636:**  
Immunofluorescent staining of human cell line U-2 OS shows positivity in cytoplasm & plasma membrane.

## Reagents for Immunofluorescence

| Name                                 | Cat. No.                                                   |
|--------------------------------------|------------------------------------------------------------|
| Fluoromount™ Aqueous Mounting Medium | <a href="#">F4680-25ML</a>                                 |
| Fluoroshield with PI                 | <a href="#">F5932-20ML</a>                                 |
| Fluoroshield with DAPI               | <a href="#">F6057-20ML</a>                                 |
| Fluoroshield                         | <a href="#">F6182-20ML</a>                                 |
| Poly-L-lysine solution               | <a href="#">P8920-100ML</a><br><a href="#">P8920-500ML</a> |

## Cell Labeling Kits



PKH26-labeled young migrating neurons invading the developing cortex. (Photo courtesy of H. Wichterle and Dr. A. Alvarez-Buylla, The Rockefeller University).

PKH and CellVue® Fluorescent Cell Linker Kits provide fluorescent labeling of live cells over an extended period of time, with no apparent toxic effects. Fluorescent linker kits are effective for a variety of cell types and exhibit no significant leaking, or transfer from cell to cell. They provide stable, clear, intense, accurate and reproducible fluorescent labeling of cells. Proprietary cell linker technology incorporates aliphatic reporter molecules into the cell membrane lipid bilayer by selective partitioning.

Four fluorescent linkers are available. PKH2 and PKH67 are green fluorochromes with excitation (490 nm) and emission (504 nm) similar to fluorescein, while PKH26 is a red fluorochrome, has excitation (551 nm) and emission (567 nm) characteristics compatible with rhodamine or phycoerythrin detection systems. PKH26 may also be excited by the 488 nm emission of an argon-ion laser. CellVue® Claret is a far-red fluorochrome which is independent of pH in physiologic ranges, and has excitation (655 nm) and emission (675 nm) characteristics compatible with a red diode laser. The linkers are physiologically stable and show little to no

toxic side-effects on cell systems. Labeled cells retain both biological and proliferative activity, and are ideal for cell tracking and cell-cell interaction studies.

Due to the non-specific labeling mechanism of the cell linkers, a wide variety of cell types have been labeled successfully. The linkers have been applied to both animal and plant cells as well as other membrane containing particles. The pattern of staining is dependent upon the cell type being labeled and the membrane of the cells. Although most applications center around general labeling (GL) methods involving membrane incorporation of the probes, the linkers may also be used for selective phagocytic cell labeling (PCL). Appearance of labeled cells may vary from bright "immunofluorescence" labeling to a punctate or patchy appearance. Since the labeling is not a saturation reaction, but rather a function of both dye and cell concentration, it is essential that the amount of dye available for incorporation be limited. Overlabeling of the cells will result in loss of membrane integrity and cell recovery.

| Name                                                                            | Cat. No.                      |
|---------------------------------------------------------------------------------|-------------------------------|
| PKH67 Green Fluorescent Cell Linker Midi Kit for General Cell Membrane Labeling | <a href="#">MIDI67-1KT</a>    |
| PKH26 Red Fluorescent Cell Linker Mini Kit for General Cell Membrane Labeling   | <a href="#">MINI26-1KT</a>    |
| PKH67 Green Fluorescent Cell Linker Mini Kit for General Cell Membrane Labeling | <a href="#">MINI67-1KT</a>    |
| PKH26 Red Fluorescent Cell Linker Kit for General Cell Membrane Labeling        | <a href="#">PKH26GL-1KT</a>   |
| PKH26 Red Fluorescent Cell Linker Kit for Phagocytic Cell Labeling              | <a href="#">PKH26PCL-1KT</a>  |
| PKH2 Green Fluorescent Cell Linker Kit for General Cell Membrane Labeling       | <a href="#">PKH2GL-1KT</a>    |
| PKH2 Green Fluorescent Cell Linker Kit for Phagocytic Cell Labeling             | <a href="#">PKH2PCL-1KT</a>   |
| PKH67 Green Fluorescent Cell Linker Kit for General Cell Membrane Labeling      | <a href="#">PKH67GL-1KT</a>   |
| CellVue® Claret Far Red Fluorescent Cell Linker Midi Kit                        | <a href="#">MIDCLARET-1KT</a> |
| CellVue® Claret Far Red Fluorescent Cell Linker Mini Kit                        | <a href="#">MINCLARET-1KT</a> |



## 1500 New ECACC® Cell Lines

# Cell Culture

## Cell Lines

We have recently added over 1500 new ECACC® cell lines to our portfolio in the U.S. Many hard-to-get cell lines are included so that the time and effort required for

procurement will be greatly reduced. All cell lines are authenticated and mycoplasma tested so you can use them in your applications with confidence. The cell lines can be used in a variety of applications

including, cancer research, neurobiology, and toxicology. For a more extensive listing of cell lines, visit [sigma.com/ecacc](https://sigma.com/ecacc). Check the site often as we are continually increasing our offering.

| Name                       | Description                                              | Biological Source                                      | Cat. No.     |
|----------------------------|----------------------------------------------------------|--------------------------------------------------------|--------------|
| CHO Protein-Free Cell Line | Chinese hamster ovary                                    | from Chinese hamster ovary cells                       | 00102307-1VL |
| 1301 Cell Line             | T-cell leukemia                                          | human                                                  | 01051619-1VL |
| MDCK-SIAT1 Cell Line       | Canine Cocker Spaniel Kidney Sialic Acid Over Expression | canine                                                 | 05071502-1VL |
| MRC-5 PD 19 Cell Line      | Human fetal lung                                         | human                                                  | 05072101-1VL |
| MRC-5 Cell Line            | Fetal lung fibroblast-like                               | human                                                  | 84101801-1VL |
| MDCK Cell Line             | Normal female kidney                                     | canine                                                 | 84121903-1VL |
| L929 Cell Line             | mouse C3H/An connective tissue                           | from mouse                                             | 85011425-1VL |
| J774.2 Cell Line           | BALB/C monocyte macrophage                               | from mouse                                             | 85011428-1VL |
| Hep G2 Cell Line           | hepatocyte carcinoma                                     | human                                                  | 85011430-1VL |
| BHK 21 (Clone 13)          | kidney                                                   | from hamster                                           | 85011433-1VL |
| U937 Cell Line             | Lymphoblast from lung                                    | human                                                  | 85011440-1VL |
| IMR-90 Cell Line           | Human Caucasian fetal lung fibroblast                    | human                                                  | 85020204-1VL |
| Hep-2C Cell Line           | human cervix carcinoma (HeLa derivative)                 | human                                                  | 85020207-1VL |
| CHO Cell Line Chinese      | ovary                                                    | from hamster                                           | 85050302-1VL |
| CHO-K1 Cell Line           | ovary                                                    | from hamster                                           | 85051005-1VL |
| HT55 Cell Line             | Human colon carcinoma                                    | human                                                  | 85061105-1VL |
| SP2/O-Ag14 Cell Line       | Non-producing hybridoma                                  | murine                                                 | 85072401-1VL |
| A431 Cell Line             | squamous carcinoma                                       | human                                                  | 85090402-1VL |
| OAW28 Cell Line            | ovarian tumor epithelial                                 | human                                                  | 85101601-1VL |
| 293 Cell Line              | embryonic kidney                                         | human                                                  | 85120602-1VL |
| CACO-2 Cell Line           | Caucasian colon adenocarcinoma                           | human                                                  | 86010202-1VL |
| A549 Cell Line             | human lung carcinoma                                     | human                                                  | 86012804-1VL |
| 1321N1 Cell Line           | Glial cells from brain astrocytoma                       | human                                                  | 86030402-1VL |
| 3T3 L1 Cell Line           | embryo                                                   | from mouse                                             | 86052701-1VL |
| PC-12 Cell Line            | adrenal gland pheochromocytoma                           | from rat                                               | 88022401-1VL |
| Jurkat E6.1 Cell Line      | leukemic T cell lymphoblast                              | human                                                  | 88042803-1VL |
| THP 1 Cell Line            | Leukemic monocyte                                        | human                                                  | 88081201-1VL |
| Fao Cell Line              | rat hepatoma                                             | from rat                                               | 89042701-1VL |
| Sf9 Cell Line              | For <i>Baculovirus</i> vectors                           | from <i>Spodoptera frugiperda</i> pupal ovarian tissue | 89070101-1VL |
| K562 Cell line             | chronic myelogenous leukemia                             | human                                                  | 89121407-1VL |
| Nthy-ori 3-1 Cell Line     | thyroid follicular epithelial                            | human                                                  | 90011609-1VL |
| RAW 264.7 Cell Line        | Macrophage from blood                                    | murine                                                 | 91062702-1VL |
| MDA-MB-231 Cell Line       | human breast adenocarcinoma                              | human                                                  | 92020424-1VL |
| ND7/23 Cell Line           | Mouse neuroblastoma X Rat neuron hybrid                  | -                                                      | 92090903-1VL |

| Name                | Description                                        | Biological Source | Cat. No.     |
|---------------------|----------------------------------------------------|-------------------|--------------|
| HeLa Cell Line      | epitheloid cervix carcinoma                        | human             | 93021013-1VL |
| TF1 Cell Line       | Erythroleukemic cell line from blood.              | human             | 93022307-1VL |
| NIH 3T3 Cell Line   | Embryonic fibroblast                               | murine            | 93061524-1VL |
| A2780cis Cell Line  | ovarian carcinoma                                  | human             | 93112517-1VL |
| A2780 Cell Line     | ovarian carcinoma                                  | human             | 93112519-1VL |
| SH-SY5Y Cell Line   | Neuroblast from neural tissue.                     | human             | 94030304-1VL |
| FTC-133 Cell Line   | Human follicular thyroid carcinoma                 | human             | 94060901-1VL |
| PNT2 Cell Line      | Normal prostate epithelium immortalized with SV40. | human             | 95012613-1VL |
| RPMI 8866 Cell Line | Lymphoblastoid from blood                          | human             | 95041316-1VL |
| NCI-H322 Cell Line  | Human Caucasian bronchioalveolar carcinoma         | human             | 95111734-1VL |
| OE21 Cell Line      | Caucasian oesophageal squamous cell carcinoma      | human             | 96062201-1VL |
| OE33 Cell Line      | Caucasian esophageal carcinoma                     | human             | 96070808-1VL |
| OE19 Cell Line      | -                                                  | human             | 96071721-1VL |
| B9 Cell Line        | Mouse B cell hybridoma                             | from mouse        | 96080128-1VL |
| tsa201 Cell Line    | embryonal kidney, SV40 transformed                 | human             | 96121229-1VL |
| Nb2-11 Cell Line    | Thymus/lymph node, lymphoblast morphology          | from rat          | 97041101-1VL |
| Ishikawa Cell Line  | endometrial adenocarcinoma                         | human             | 99040201-1VL |

## Reagents for Detecting and Eliminating Mycoplasma Contamination

| Name                                              | Cat. No.    |
|---------------------------------------------------|-------------|
| LookOut® mycoplasma qPCR detection kit            | MP0040-1KT  |
| VenorGeM® Mycoplasma Detection Kit, PCR-based     | MP0025-1KT  |
| LookOut® Mycoplasma PCR Detection Kit             | MP0035-1KT  |
| LookOut® Mycoplasma Elimination Kit               | MP0030-1KT  |
| LookOut® Mycoplasma Erase, Mycoplasma erase spray | L1420-500ML |

## Reagents for 3-D Cell Culture

| Name                                                                                      | Cat. No.                             |
|-------------------------------------------------------------------------------------------|--------------------------------------|
| HydroMatrix™ Peptide Cell Culture Scaffold, mixture                                       | A6982-1ML<br>A6982-5ML<br>A6982-10ML |
| MaxGel™ ECM , mixture                                                                     | E0282-100UL<br>E0282-1ML             |
| HydroMatrix™ Peptide Cell Culture Scaffold, 96 well plate                                 | H4165-1EA                            |
| HydroMatrix™ Peptide Cell Culture Scaffold, 24 well plate                                 | H4040-1EA                            |
| HydroMatrix™ Peptide Cell Culture Scaffold, 6 well plate                                  | H3915-1EA                            |
| HyStem™ Cell Culture Scaffold Kit, Trial Kit, For 2.5 mL of hydrogel scaffold solution    | HYS010-1KT                           |
| HyStem™ Cell Culture Scaffold Kit, For 7.5 mL of hydrogel scaffold solution               | HYS020-1KT                           |
| HyStem™-C Cell Culture Scaffold Kit, For 7.5 mL of hydrogel scaffold solution             | HYSC020-1KT                          |
| HyStem™-C Cell Culture Scaffold Kit, Trial Kit, For 2.5 mL of hydrogel scaffold solution  | HYSC010-1KT                          |
| HyStem™-HP Cell Culture Scaffold Kit, For 7.5 mL of hydrogel scaffold solution            | HYSHP020-1KT                         |
| HyStem™-HP Cell Culture Scaffold Kit, Trial Kit, For 2.5 mL of hydrogel scaffold solution | HYSHP010-1KT                         |
| MaxGel™ ECM , 96 well plate                                                               | M1073-1EA                            |

## Reagents for Stem Cell Culture

Stem cell biology offers astonishing research potential. Sigma® Life Science has the innovations you need to discover the promise it holds. Access a world of RNAi with the MISSION® RNAi Library, efficiently edit genes of interest using advanced CompoZr® ZFN technology, and characterize your

stem cells with our Prestige Antibodies®, powered by Atlas Antibodies. Optimized formulations and proven, consistent results have earned Sigma's Stemline Media a reputation of quality and excellence. Ideal for expansion and maintenance of neural, hematopoietic, and other adult stem cells, Stemline media provide optimal, consistent cellular environments. Produced in a GMP

state-of-the-art facility with an available Device Master File (DMF), Stemline Media are clearly an excellent choice for your stem cell applications.

The applications are endless—and so are the possibilities.

| Name                                                                                              | Cat. No.                     |
|---------------------------------------------------------------------------------------------------|------------------------------|
| Stemline® Hematopoietic Stem Cell Expansion Medium, Serum-free, Without L-glutamine               | S0189-500ML<br>S0189-6X500ML |
| Stemline® II Hematopoietic Stem Cell Expansion Medium, Serum-free, contains L-glutamine           | S0192-500ML<br>S0192-6X500ML |
| Stemline® Keratinocyte Medium II                                                                  | S0196-500ML                  |
| Stemline® Mesenchymal Stem Cell Expansion Medium, Without L-glutamine                             | S1569-1L                     |
| Stemline® T Cell Expansion Medium, Serum-free, Without L-glutamine                                | S1694-1L                     |
| Stemline® Neural Stem Cell Expansion Medium, without L-glutamine, growth factors, and antibiotics | S3194-500ML                  |
| Stemline® Dendritic Cell Maturation Medium, Serum-free, Without L-glutamine                       | S3444                        |
| Stemline® Keratinocyte Growth Supplement, For use with S0196, Stemline® Keratinocyte Medium II    | S9945-1VL                    |

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## Cell Culture Labware

# Cell Culture Labware

## Equipment



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                                                                                                                | Cat. No.    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Jenco™ inverted compound microscopes, 30W halogen bulb                                                                                              | Z723975-1EA |
| Jenco™ inverted compound microscopes, 30W halogen bulb                                                                                              | Z724084-1EA |
| Hypoxia Chamber Glove Box, CO <sub>2</sub> range: 0 - 20% C, sensor accuracy: 0.2%, O <sub>2</sub> range: 0 - 25% with sensor accuracy of +/- 0.25% | Z736848-1EA |

## Specialty Surfaces and Formats



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                                                         | Cat. No.                                    |
|----------------------------------------------------------------------------------------------|---------------------------------------------|
| Corning® CellBIND® cell culture plates, 6 wells                                              | CLS3335-5EA<br>CLS3335-50EA                 |
| Corning® CellBIND® cell culture plates, 12 wells                                             | CLS3336-50EA                                |
| Corning® CellBIND® cell culture plates, 24 wells                                             | CLS3337-5EA<br>CLS3337-50EA                 |
| Corning® CellBIND® cell culture plates, 48 wells                                             | CLS3338-50EA                                |
| Corning® Ultra-low attachment multiwell plates, 6 wells                                      | CLS3471-24EA                                |
| Corning® Ultra-low attachment multiwell plates                                               | CLS3473-24EA                                |
| Corning® Ultra-low attachment multiwell plates, 96 wells                                     | CLS3474-24EA                                |
| Corning® Costar® cell culture plates, 6 well, flat bottom                                    | CLS3506-100EA                               |
| Corning® Costar® cell culture plates, 6 well, flat bottom (Individually wrapped)             | CLS3516-1EA<br>CLS3516-10EA<br>CLS3516-50EA |
| Corning® Costar® cell culture plates, 12 well, flat bottom                                   | CLS3512-100EA                               |
| Corning® Costar® cell culture plates, 12 well, flat bottom                                   | CLS3513-50EA                                |
| Corning® Costar® cell culture plates, 24 well, flat bottom                                   | CLS3527-100EA                               |
| Corning® Costar® cell culture plates, 24 well, flat bottom                                   | CLS3526-1EA<br>CLS3526-50EA                 |
| Corning® Costar® cell culture plates, 24 well, flat bottom                                   | CLS3524-100EA                               |
| Corning® Costar® cell culture plates, 48 well, flat bottom                                   | CLS3548-100EA                               |
| Corning® Costar® cell culture plates, 96 well, flat bottom                                   | CLS3595-1EA<br>CLS3595-10EA<br>CLS3595-50EA |
| Corning® Costar® cell culture plates, 96 well, flat bottom, with special low evaporation lid | CLS3585-50EA                                |
| Corning® Costar® cell culture plates, 96 well, flat bottom                                   | CLS3596-50EA                                |
| Corning® Costar® cell culture plates, 96 well, flat bottom                                   | CLS3997-10EA<br>CLS3997-50EA                |
| Corning® Costar® cell culture plates, growth area 0.32 cm <sup>2</sup>                       | CLS3598-100EA                               |
| Corning® Costar® cell culture plates, 96 well, flat bottom                                   | CLS3599-100EA                               |
| Corning® Costar® cell culture plates, 96 well, round bottom                                  | CLS3799-1EA<br>CLS3799-50EA                 |

| Name                                                                                            | Cat. No.     |
|-------------------------------------------------------------------------------------------------|--------------|
| Corning® Costar® cell culture plates, 8 well strip plate, assembled 12 strips per 96 well plate | CLS9102-50EA |
| Nunc™ D Multidishes, 4 well round                                                               | D6789-1CS    |
| Nunc™ D Multidishes, 12 well round                                                              | D6315-1CS    |
| Nunc™ D Multidishes, 24 well round                                                              | D7039-1CS    |
| Nunc™ D Multidishes, 48 well round                                                              | D6440-1CS    |
| Nunc® MicroWell™ mini tray, 60 well                                                             | M0815-100EA  |
| Nunc® MicroWell™ mini tray, 72 well                                                             | M0690-100EA  |

## Multiwell Plate Inserts



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                     | Cat. No.     |
|----------------------------------------------------------|--------------|
| Corning® HTS Transwell® 96 well permeable support        | CLS3381-1EA  |
| Corning® HTS Transwell® 96 well permeable support        | CLS3391-5EA  |
| Corning® HTS Transwell® 96 well permeable support        | CLS3380-1EA  |
| Corning® HTS Transwell® 96 well permeable support        | CLS3392-5EA  |
| Corning® HTS Transwell® 96 well permeable support        | CLS3374-2EA  |
| Corning® HTS Transwell® 96 well permeable support        | CLS3384-8EA  |
| Corning® HTS Transwell®-24 well permeable support        | CLS3396-2EA  |
| Corning® HTS Transwell®-24 well permeable support        | CLS3398-2EA  |
| Corning® HTS Transwell®-24 well permeable support        | CLS3397-12EA |
| Corning® HTS Transwell®-24 well permeable support        | CLS3399-12EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3401-48EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3402-48EA |
| Corning® Snapwells™ inserts                              | CLS3407-24EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3413-48EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3412-24EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3419-12EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3415-48EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3414-24EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3420-12EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3421-48EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3422-48EA |
| Corning® Transwell® polycarbonate membrane inserts       | CLS3428-24EA |
| Corning® Transwell® polyester membrane inserts           | CLS3470-48EA |
| Corning® Transwell® polyester membrane inserts           | CLS3460-48EA |
| Corning® Transwell® polyester membrane inserts           | CLS3450-24EA |
| Corning® Transwell® polyester membrane inserts           | CLS3472-48EA |
| Corning® Transwell® polyester membrane inserts           | CLS3462-48EA |
| Corning® Transwell® polyester membrane inserts           | CLS3452-24EA |
| Corning® Netwells® inserts                               | CLS3477-48EA |
| Corning® Netwells® inserts                               | CLS3478-48EA |
| Corning® Netwells® inserts                               | CLS3479-48EA |
| Corning® Netwells® inserts                               | CLS3480-48EA |
| Corning® Transwell®-COL collagen-coated membrane inserts | CLS3491-24EA |
| Corning® Transwell®-COL collagen-coated membrane inserts | CLS3492-24EA |
| Corning® Transwell®-COL collagen-coated membrane inserts | CLS3493-24EA |
| Corning® Transwell®-COL collagen-coated membrane inserts | CLS3494-24EA |
| Corning® Transwell®-COL collagen-coated membrane inserts | CLS3495-24EA |
| Corning® Transwell®-COL collagen-coated membrane inserts | CLS3496-24EA |

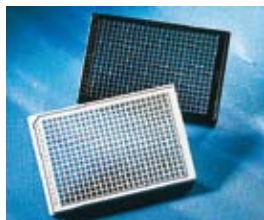
## 1536-Well Plates



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                                         | Cat. No.                     |
|------------------------------------------------------------------------------|------------------------------|
| Corning® 1536 well plate, solid black, tissue-culture treated plate          | CLS3726-10EA<br>CLS3726-50EA |
| Corning® 1536 well plate, solid white, tissue-culture treated plate with lid | CLS3727-50EA                 |
| Corning® 1536 well plate, solid black, NBS surface plate                     | CLS3728-10EA<br>CLS3728-50EA |
| Corning® low volume 2 µL 1536 well multiwell plates                          | CLS3855-100EA                |
| Greiner® high and medium binding 1536 well plates                            | M7686-60EA                   |
| Greiner® high and medium binding 1536 well plates                            | M7561-60EA                   |

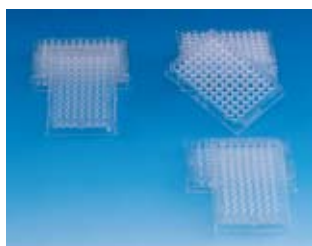
## 384-Well Plates



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                               | Cat. No.                      |
|------------------------------------|-------------------------------|
| Corning® 384 Well Plates           | CLS3822-10EA<br>CLS3822-50EA  |
| Corning® 384 Well Plates           | CLS3571-10EA<br>CLS3571-50EA  |
| Corning® 384 Well Plates           | CLS3542-10EA<br>CLS3542-50EA  |
| Corning® 384 Well Plates           | CLS3985-100EA                 |
| Corning® 384 Well Plates           | CLS3712-20EA<br>CLS3712-100EA |
| Corning® 384 Well Plates           | CLS3570-10EA<br>CLS3570-50EA  |
| Corning® 384 Well Plates           | CLS3663-100EA                 |
| Corning® 384 Well Plates           | CLS3707-20EA<br>CLS3707-100EA |
| Corning® 384 Well Plates           | CLS3680-100EA                 |
| Corning® 384 Well Plates           | CLS3701-20EA<br>CLS3701-100EA |
| Corning® 384 Well Plates           | CLS3662-100EA                 |
| Corning® CellBIND® 384 Well Plates | CLS3683-50EA                  |
| Nunc® polystyrene 384 well plates  | P5991-1CS                     |

## 96-Well Plates

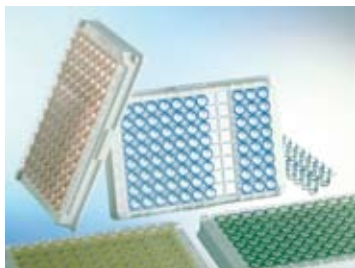


For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                            | Cat. No.      |
|-----------------------------------------------------------------|---------------|
| Well cap for Nunc® 96 DeepWell plates                           | C1111-50EA    |
| Corning® Universal-BIND™ Plate, 96 well                         | CLS2503-50EA  |
| Corning® Sulfhydryl-BIND™ 96 well plate, 96 well                | CLS2509-50EA  |
| Corning® 96 Well Plates, non-treated                            | CLS2595-100EA |
| Corning® 96 Well Plates, non-treated                            | CLS2797-100EA |
| Corning® 96 Well Plates, non-treated                            | CLS2897-100EA |
| Corning® Robolids 96 well, 96 well                              | CLS3090-50EA  |
| Corning® CellBIND® 96 Well Plates                               | CLS3300-50EA  |
| Corning® CellBIND® 96 Well Plates                               | CLS3340-50EA  |
| Corning® 96 Well Plates, non-treated                            | CLS3370-100EA |
| Corning® 96 Well Plates, non-treated                            | CLS3367-50EA  |
| Corning® 96 Well Plates, tissues culture treated                | CLS3358-100EA |
| Corning® 96 Well Plates, tissue culture treated                 | CLS3360-100EA |
| Corning® HTS Transwell® 96 well permeable support               | CLS3381-1EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3380-1EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3374-2EA   |
| Corning® HTS Transwell®-96 well accessory plate, receiver plate | CLS3382-10EA  |
| Corning® HTS Transwell® 96 well permeable support               | CLS3391-5EA   |

| Name                                                            | Cat. No.      |
|-----------------------------------------------------------------|---------------|
| Corning® HTS Transwell® 96 well permeable support               | CLS3392-5EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3385-2EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3386-8EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3384-8EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3387-8EA   |
| Corning® HTS Transwell® 96 well permeable support               | CLS3388-2EA   |
| Corning® HTS Transwell® 96 well accessory plate, receiver plate | CLS3583-10EA  |
| Corning® volume adapter for 96 well filter plates               | CLS3584-50EA  |
| Corning® NBS™ 96 well plates, without lids, SPA                 | CLS3600-100EA |
| Corning® 96 Well Plates, Clear Bottom, high binding             | CLS3601-100EA |
| Corning® 96 Well Plates, Clear Bottom, tissue culture treated   | CLS3603-48EA  |
| Corning® NBS™ 96 well plates, without lids, SPA                 | CLS3604-100EA |
| Corning® NBS™ 96 well plates, without lids, SPA                 | CLS3605-100EA |
| Corning® 96 Well Plates, Clear Bottom, tissue culture treated   | CLS3610-48EA  |
| Corning® 96 well special optics plates, tissue culture treated  | CLS3614-100EA |
| Corning® 96 well special optics plates, non-treated             | CLS3615-100EA |
| Corning® 96 Well Plates, tissue culture treated                 | CLS3628-100EA |
| Corning® 96 Well Plates, Clear Bottom, non-treated              | CLS3631-100EA |
| Corning® NBS™ 96 well plates, without lids, fluorescence        | CLS3650-100EA |
| Corning® NBS™ 96 well plates, without lids, fluorescence        | CLS3651-100EA |
| Corning® NBS™ 96 well plates, without lids                      | CLS3641-100EA |
| Corning® 96 well special optics plates, tissue culture treated  | CLS3720-25EA  |
| Corning® 96 Well Plates, non-treated                            | CLS3795-100EA |
| Corning® 96 Well Plates, non-treated                            | CLS3896-48EA  |
| Corning® 96 Well Plates, non-treated                            | CLS3897-100EA |
| Corning® 96 Well Plates, non-treated                            | CLS3898-100EA |
| Corning® 96 Well Plates, non-treated                            | CLS3798-100EA |
| Corning® 96 Well Plates, Clear Bottom, tissue culture treated   | CLS3904-100EA |
| Corning® 96 Well Plates, Clear Bottom, tissue culture treated   | CLS3903-100EA |
| Corning® 96 Well Plates, NBS™                                   | CLS3990-25EA  |
| Nunc-Immuno™ plates, 96-well plate, MaxiSorp                    | M9410-1CS     |
| Nunc-Immuno™ plates, 96-well plate, MaxiSorp, with certificate  | M5785-1CS     |
| Nunc-Immuno™ plates, 96-well plate, PolySorp                    | M0661-1CS     |
| Nunc® MicroWell™ 96 well polystyrene plates                     | P4241-50EA    |
| Nunc® amplification plates, 96 well with mini skirt             | P4741-50EA    |
| Nunc® MicroWell™ 96 well polystyrene plates                     | P5366-50EA    |
| Nunc® MicroWell™ 96 well polypropylene plates                   | P6991-1CS     |
| Nunc® MicroWell™ 96 well polystyrene plates                     | P7491-1CS     |
| Nunc® 96 deepwell plates                                        | P8241-50EA    |
| Nunc® 96 deepwell plates                                        | P8116-50EA    |
| Nunc® FluoroNunc™ 96 well plates                                | P8616-50EA    |
| Nunc® FluoroNunc™ 96 well plates                                | P8741-50EA    |
| Nunc® MicroWell™ 96 well optical bottom plates                  | P8866-30EA    |
| Nunc® MicroWell™ 96 well optical bottom plates                  | P8991-30EA    |
| Nunc® amplification plates, 96 well Silicon spacer plate        | S6315-1EA     |
| Nunc® 96 deepwell plates                                        | Z717266-60EA  |
| Nunc® 96 deepwell plates                                        | Z717274-60EA  |

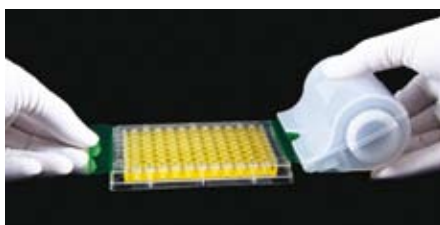
## Small Format Plates



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                                                   | Cat. No.     |
|----------------------------------------------------------------------------------------|--------------|
| Corning® Universal-BIND™ Plate, 1 × 8 Stripwell plate                                  | CLS2504-50EA |
| Greiner® multiwell plates for culture scale up, 6 wells (TC treated with lid)          | M8562-100EA  |
| Greiner® multiwell plates for culture scale up, 6 wells (suspension culture with lid)  | M9062-100EA  |
| Greiner® multiwell plates for culture scale up, 12 wells (TC treated with lid)         | M8687-100EA  |
| Greiner® multiwell plates for culture scale up, 12 wells (suspension culture with lid) | M9187-100EA  |
| Greiner® multiwell plates for culture scale up, 24 wells (TC treated with lid)         | M8812-100EA  |
| Greiner® multiwell plates for culture scale up, 24 wells (suspension culture with lid) | M9312-100EA  |
| Greiner® multiwell plates for culture scale up, 48 wells (TC treated with lid)         | M8937-100EA  |
| Greiner® multiwell plates for culture scale up, 48 wells (suspension culture with lid) | M9437-100EA  |
| Greiner® Multiwell Strips, medium binding                                              | S6688-400EA  |
| Greiner® Multiwell Strips, high binding                                                | S7063-400EA  |
| Greiner® Multiwell Strips, high binding                                                | S6063-400EA  |
| Greiner® Multiwell Strips, high binding                                                | S6563-300EA  |

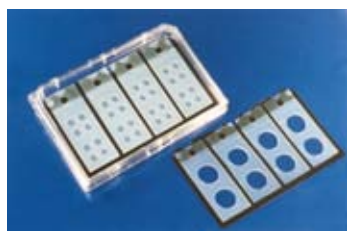
## Multiwell Plate Sealing Films



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                                                                                                      | Cat. No.                   |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| AeraSeal™ film                                                                                                                            | A9224-50EA                 |
| SealPlate® film                                                                                                                           | Z369667-100EA              |
| SealPlate® MiniStrips™ film                                                                                                               | <b>Z707392</b>             |
| ThinSeal™ film                                                                                                                            | Z707414-100EA              |
| EZ-Pierce™ films                                                                                                                          | Z721581-100EA              |
| EZ-Pierce™ films                                                                                                                          | Z721603-50EA               |
| EZ-Pierce™ ColorTabs™, printed with color dots                                                                                            | Z721638-50EA               |
| Zone-Free™ Films                                                                                                                          | Z721654-50EA               |
| X-Pierce™ film                                                                                                                            | Z722529-50EA               |
| AbsorbMax™ film                                                                                                                           | Z722545-50EA               |
| SealMate™ System for Adhesive Microplate-Sealing Films, SealPlate® starter kit, includes SealMate™ dispenser + 2 rolls of SealPlate® film | Z724858-1EA                |
| SealMate™ System for Adhesive Microplate-Sealing Films, AeraSeal™ starter kit, includes SealMate™ dispenser + 2 rolls of AeraSeal™ film   | Z725072-1EA                |
| SealMate™ System for Adhesive Microplate-Sealing Films, SealMate™ dispenser only                                                          | Z725404-4EA<br>Z725404-1EA |
| SealMate™ System for Adhesive Microplate-Sealing Films, SealPlate® rolls                                                                  | Z725854-8EA<br>Z725854-2EA |
| SealMate™ System for Adhesive Microplate-Sealing Films, AeraSeal™ rolls                                                                   | Z726281-8EA<br>Z726281-2EA |

## Grace Bio-Labs Coverslip System



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                                       | Cat. No.   |
|----------------------------------------------------------------------------|------------|
| Culturewell™ coverslip system, 2 wells                                     | C6610-10EA |
| Culturewell™ coverslip system, 2 wells                                     | C6735-10EA |
| Culturewell™ coverslip system, 4 wells                                     | C6860-10EA |
| Culturewell™ coverslip system, 50 wells                                    | C7110-10EA |
| Culturewell™ coverslip system, coverslips only (5 pouches of 4 coverslips) | C8110-1PAK |

## Coated Plates



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                               | Cat. No.                     |
|----------------------------------------------------|------------------------------|
| CollagenPRO™ COAT cultureware, culture dish, 35 mm | <a href="#">Z380512-20EA</a> |
| CollagenPRO™ COAT cultureware, culture flask, T-25 | <a href="#">Z380520-10EA</a> |
| CollagenPRO™ COAT cultureware, 6 well plate        | <a href="#">Z380539-5EA</a>  |
| CollagenPRO™ COAT cultureware, 24 well plate       | <a href="#">Z380490-5EA</a>  |
| CollagenPRO™ COAT cultureware, 96 well plate       | <a href="#">Z380504-5EA</a>  |

## Grace Bio-Labs Perfusion Chambers



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                                | Cat. No.                     |
|-----------------------------------------------------|------------------------------|
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379034-40EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379042-40EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379050-20EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379069-20EA</a> |
| CoverWell™ perfusion chambers, 8 chambers per slide | <a href="#">Z379204-20EA</a> |
| CoverWell™ perfusion chambers, 8 chambers per slide | <a href="#">Z379212-20EA</a> |
| CoverWell™ perfusion chambers, 8 chambers per slide | <a href="#">Z379220-10EA</a> |
| CoverWell™ perfusion chambers, 8 chambers per slide | <a href="#">Z379239-10EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379077-40EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379085-40EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379093-20EA</a> |
| CoverWell™ perfusion chambers, 1 chamber per slide  | <a href="#">Z379107-20EA</a> |
| CoverWell™ perfusion chambers, 3 chambers per slide | <a href="#">Z379115-40EA</a> |
| CoverWell™ perfusion chambers, 3 chambers per slide | <a href="#">Z379123-40EA</a> |
| CoverWell™ perfusion chambers, 3 chambers per slide | <a href="#">Z379131-20EA</a> |
| CoverWell™ perfusion chambers, 3 chambers per slide | <a href="#">Z379158-20EA</a> |
| CoverWell™ perfusion chambers, 4 chambers per slide | <a href="#">Z379166-40EA</a> |
| CoverWell™ perfusion chambers, 4 chambers per slide | <a href="#">Z379174-40EA</a> |
| CoverWell™ perfusion chambers, 4 chambers per slide | <a href="#">Z379182-20EA</a> |
| CoverWell™ perfusion chambers, 4 chambers per slide | <a href="#">Z379190-20EA</a> |

## Grace Bio-Labs Imaging Chambers



For a complete selection of these products please visit [sigma.com/labware](https://sigma.com/labware)

| Name                                         | Cat. No.                     |
|----------------------------------------------|------------------------------|
| CoverWell™ imaging chambers, Adhesive backed | <a href="#">C9599-40EA</a>   |
| CoverWell™ imaging chambers, Adhesive backed | <a href="#">C9724-40EA</a>   |
| CoverWell™ imaging chambers, Adhesive backed | <a href="#">C9849-20EA</a>   |
| CoverWell™ imaging chambers, Adhesive backed | <a href="#">C9974-20EA</a>   |
| CoverWell™ imaging chambers                  | <a href="#">Z365858-40EA</a> |
| CoverWell™ imaging chambers                  | <a href="#">Z365866-40EA</a> |
| CoverWell™ imaging chambers                  | <a href="#">Z365874-20EA</a> |
| CoverWell™ imaging chambers                  | <a href="#">Z365882-20EA</a> |

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