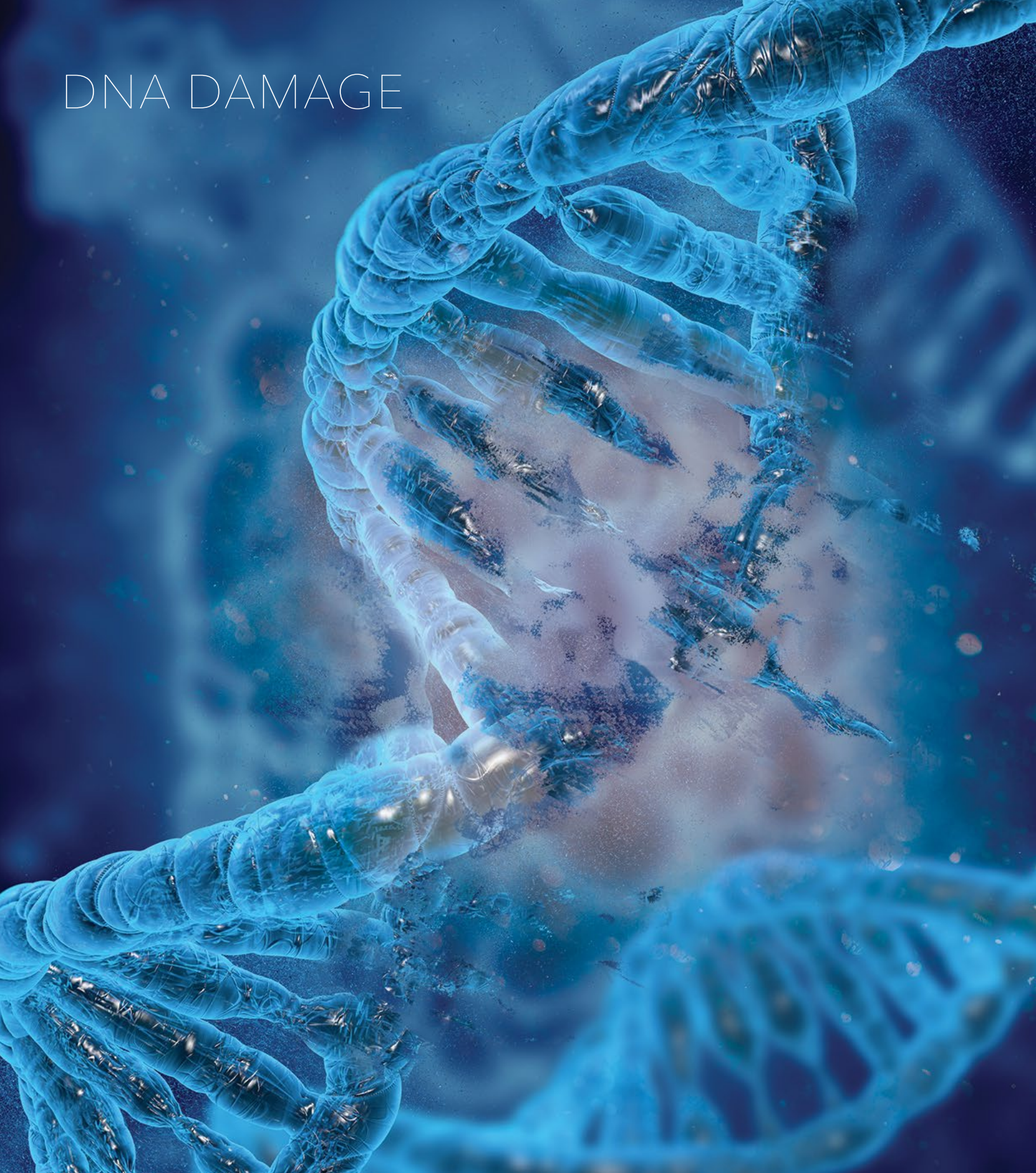


DNA DAMAGE



biotechne®

DNA DAMAGE

The maintenance of genome integrity and fidelity is essential for the proper functioning and survival of all organisms. However, this is an immense task as cells are continuously subjected to genotoxic agents (both exogenous and endogenous) that can damage its DNA. Eukaryotic cells have evolved multifaceted responses to repair DNA damage as failure to repair these lesions may result in mutations, cellular senescence, or cell death, which could lead to cancer, neurodegeneration, and other diseases. Bio-Techne offers an unparalleled selection of assays, ELISAs, and antibodies for probing DNA damage in your model system.

COMETASSAY®

The comet assay is a sensitive technique for quantifying DNA breaks in single cells. It is widely used as it is the only technique that can directly measure DNA damage. It involves the immobilization of cells in low melting point agarose (LMAgarose) on a microscope slide, the lysis of the cells to form nucleoids of supercoiled DNA loops (either under neutral or alkaline conditions), and then electrophoresis and subsequent staining of the nucleoids. The resulting image, as observed by microscopy, resembles a "comet" with a distinct head and tail. The head is composed of intact DNA, while the tail consists of single-strand (SS) or double-strand (DS) DNA breaks. The extent of DNA liberated from the head of the comet is directly proportional to the amount of DNA damage. Bio-Techne's CometAssay Standardized System provides qualified reagents, instrumentation, software and ancillary products for the generation of highly reproducible results.



COMETASSAY BENEFITS

- Qualified reagents and enzymes increase assay sensitivity
- Control cell standards to compare runs
- Treated slides with multiple formats save time and costs
- Optimized instrumentation minimize electrophoresis variability
- Automated analysis software save time and minimize bias
- Multiple tutorials and webinars for tech support

R&D SYSTEMS™ COMETASSAY® CONTROL CELLS
Cryopreserved, suspended cells with different levels of DNA damage for use as comet assay controls.

PRODUCT	SIZE	CATALOG #
CometAssay Alkaline Control Cells	1 set (10 assays)	4256-010-CC
CometAssay Neutral Control Cells	1 set (10 assays)	4257-010-NC

R&D SYSTEMS™ COMETASSAY® STARTER KITS
Available in 2, 20 and 96 well slide formats, includes a CometAssay Reagent Kit, Alkaline Control Cells, and the CometAssay Electrophoresis System.

PRODUCT	CATALOG #
CometAssay Electrophoresis System II	4250-050-ES
CometAssay Electrophoresis Starter Kit	4250-050-ESK
CometAssay 20-Well Electrophoresis Starter Kit	4252-040-ESK
CometAssay 96-Well Electrophoresis Starter Kit	4253-096-ESK

R&D SYSTEMS™ COMETASSAY® REAGENT KITS
Contains specially treated CometSlides™ (2, 20 or 96 well) and reagents for performing alkaline and neutral comet assays.

PRODUCT	SIZE	CATALOG #
CometAssay Kit	25 x 2 well slides	4250-050-K
CometAssay High-Throughput Sample Kit	2 x 20 well slides	4252-040-K
CometAssay 96-Well Kit	1 x 96 well slides	4253-096-K
CometAssay Silver Kit	25 x 2 well slides	4251-050-K
CometAssay Silver Staining Components Kit	200 samples	4254-200-K

R&D SYSTEMS™ COMETASSAY® REAGENTS AND SLIDES
Reagents and CometSlides can be purchased separately.

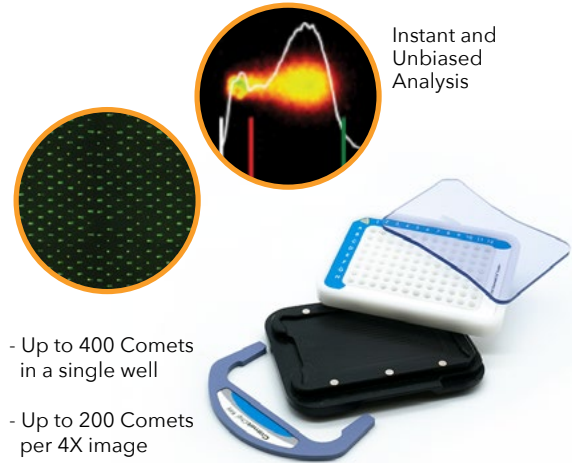
PRODUCT	SIZE	CATALOG #
CometAssay Lysis Solution	100 mL	4250-010-01
	2 x 500 mL	4250-050-01
CometAssay LMAgarose	15 mL	4250-050-02
	100 mL	4250-500-02
CometSlide, 2 well	2 slides	4250-004-03
	25 slides	4250-050-03
	100 slides	4250-200-03
CometSlide High-Throughput, 20 well	2 slides	4252-040-01
	10 slides	4252-200-01
	25 slides	4252-500-01
	100 slides	4252-02K-01
96-Well CometSlide	1 slide	4253-096-03
CometSlide Rack System	1 each	4252-040-02
200 mM EDTA (pH 10)	12.5 mL	4250-050-04

COMETCHIP®

The CometChip System is a 96-well comet assay platform that is designed for the high-throughput measurement of DNA damage. It is an array of spatially encoded micropores patterned on agarose that capture individual cells, which become immobilized in the micropores following addition of the LMAgarose overlay. Subsequent assembly of the complete CometChip System forms 96 separate macrowells with each well containing ~ 400 micropores. This system, which is designed to work with our CometAssay® Electrophoresis System and reagents, allows you to rapidly screen for DNA damage following treatment with different compounds.

UNIQUE FEATURES

- High-throughput analysis with up to 400 non-overlapping comets per well
- Lower variance between runs
- Comparable results to traditional comet assay
- Versatility for multiple cell types
- Reproducible data
- Cost savings with 10,000% increase in throughput
- Developed and manufactured under ISO 9001/2008 guidelines



Instant and Unbiased Analysis

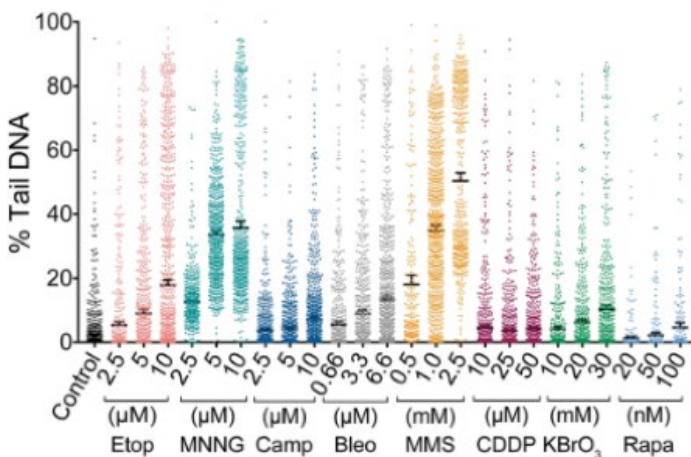
- Up to 400 Comets in a single well

- Up to 200 Comets per 4X image

R&D Systems™ CometChip® Kit (Catalog # 4260-096-K)		
PRODUCT	SIZE	CATALOG #
CometChip, 30 µm	1 each	4260-096-01
Lysis Solution	100 mL	4250-010-01
CometAssay LMAgarose	15 mL	4250-050-02

R&D Systems™ CometChip® Starter Kit (Catalog # 4260-096-CSK)		
PRODUCT	SIZE	CATALOG #
CometChip Kit	1 each	4260-096-K
96-Well CometChip System	1 system	4260-096-CS

R&D Systems™ CometChip® Electrophoresis Starter Kit (Catalog # 4260-096-ESK)		
PRODUCT	SIZE	CATALOG #
CometChip Starter Kit	1 each	4260-096-CSK
CometAssay Electrophoresis System II	1 system	4250-050-ES



Analysis of DNA Damage in MCF-7 by the CometChip System. The MCF-7 human breast cancer cell line was treated for 1 hour with increasing concentrations of one of eight different DNA damaging agents, etoposide (Etop), methylnitrosoguanidine (MNNG), camptothecin (Camp), bleomycin (Bleo), methyl methanesulfonate (MMS), cisplatin (CDDP), potassium bromate (KBrO₃), rapamycin (Rapa), or remained untreated (Control). Genomic DNA damage was then evaluated using the CometChip System (R&D Systems). The comet tail was analyzed to determine the extent and amount of migrated DNA (% Tail DNA) as this correlates with the number of accumulated breaks in the DNA. *Data adapted from Wilk, A. et al. (2020) Sci. Rep. 10:651.*

FLARE™ ASSAY

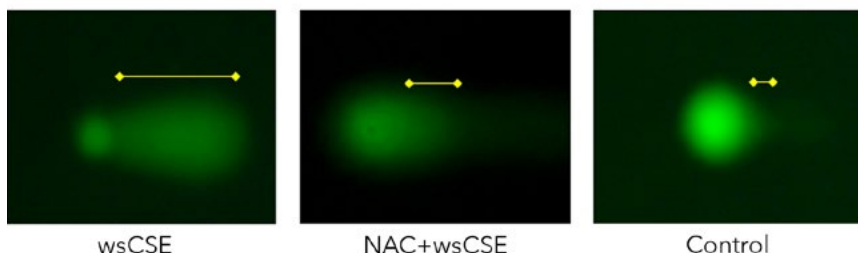
FLARE (Fragment Length Analysis using Repair Enzymes) assays are a rapid and useful method for assessing the type of DNA damage. By utilizing DNA repair enzymes in combination with the comet assay, these assays can infer the type of DNA damage by analyzing the substrate specificity of the repair enzyme. Bio-Techne offers a complete standardized system that is designed to work with our CometAssay® kits.

UNIQUE ASSAY FEATURES

- Qualified enzymes and buffers
- Designed to work with the CometAssay System
- FLARE Sample Prep and Modules are available separately

R&D SYSTEMS™ FLARE™ ASSAY KITS		
<i>Contains the DNA repair enzyme, buffers, CometAssay reagents and FLARE slides.</i>		
PRODUCT	SIZE	CATALOG #
Fpg FLARE Assay Kit	75 samples	4040-100-FK
Human 8-oxoGuanine DNA Glycosylase (hOGG1) FLARE Assay Kit	75 samples	4130-100-FK

R&D SYSTEMS™ FLARE™ ASSAY MODULES, SAMPLE PREP AND ANCILLARY REAGENTS		
<i>FLARE Assay Kit components for purchasing separately. Use the Modules (DNA repair enzyme and buffers) and Sample Prep (slides, lysis solution, LMAgarose) together to probe for DNA damage.</i>		
PRODUCT	SIZE	CATALOG #
Fpg FLARE Module	100 samples	4040-100-FM
hOGG1 FLARE Module	100 samples	4130-100-FM
hOGG1 with Buffer	100 units	4130-100-EB
	500 units	4130-500-EB
FLARE Sample Prep	75 samples	3950-075-SP
BSA Additive (100X)	100 µL	3950-100-04
FLARE Buffer 1 (25X)	40 mL	3950-040-01
FLARE Slide	25 slides	3950-075-02
	100 slides	3950-300-02
Hydrophobic Coverslips	100 each	4867-100



DNA Damage in Human Amnion Cells Assessed by FLARE Assays. Primary human amnion epithelial cells were treated with water soluble cigarette smoke extract (wsCSE) prepared in cell culture medium or remained untreated (control). A portion of treated cells were pretreated with the antioxidant N-acetyl-L-cysteine (NAC + wsCSE). Changes in oxidized nucleoside, 8-oxoG, were detected by digesting the DNA with the OGG1 repair enzyme in a FLARE assay (R&D Systems), and the comet tail was analyzed to determine the extent and amount of migrated DNA. *Data adapted from Menon, R. et al. (2013) PLoS One 8:e83416.*

COMETASSAY® ANALYSIS SOFTWARE

The CometAssay Analysis Software can evaluate large numbers of cells and generate summary statistics allowing for rapid analysis of your comet assay. It is specially engineered to complement and operate as the computational component of our CometAssay Electrophoresis System.

UNIQUE FEATURES

- Existing microscope and camera can be used to capture image
- Uses 4X and 10X images
- Step-by-step instructions provided with Comet Wizard
- Drag-and-drop images into slide library
- Automatic comet finding and scoring
- Instant and unbiased analysis
- Affordable single flat rate with no service fee

COMETASSAY® ANALYSIS SOFTWARE TEXT, BENEFITS, SPECIFICATIONS		
<i>R&D Systems™ CometAssay Analysis Software</i>		
PRODUCT	SIZE	CATALOG #
CometAssay Analysis Software	1 license	4260-000-CS

Learn more | rndsystems.com/products/cometassay

γH2AX

Histone H2AX, a variant of the H2A protein family, is a core protein in the nucleosome histone octamer and plays an important role in nucleosome formation, chromatin remodeling, and DNA repair. It becomes phosphorylated on Ser139, now being called γH2AX, in response to DNA DS breaks. γH2AX marks the site of DNA DS breaks and serves to recruit cell cycle checkpoint and DNA repair factors to the site of damage. γH2AX is often used as a marker of DNA damage as its levels become elevated within minutes of DS breaks, and the quantity of γH2AX is associated with the amount of DNA damage.

R&D Systems™ ELISAs			
PRODUCT	CATALOG #	SPECIES	DESCRIPTION
HT γH2AX ELISA Kit	4418-096-K	Ms	Measures γH2AX levels in cultured cells, peripheral blood mononuclear cells (PBMCs), and tissue.

Novus Biologicals™ and R&D Systems™ Antibodies						
MOLECULE	CATALOG #	SPECIES	CLONE	APPLICATIONS	CONJUGATES AVAILABLE	
Histone H2AX	MAB3406	H M R	322105	ICC/IF, WB	No	
	NB100-638	H M	Poly	ICC/IF, IHC, KO, WB	Yes	
Phospho-Histone H2AX (S139; γH2AX)	4418-APC-100	Ms	Poly	ICC/IF, WB	No	
	NB100-384	H M R +	Poly	ChIP, Flow, ICC/IF, IHC, KO, SW, WB	Yes	
	MAB2288*	H	2207D	CyTOF, Flow, WB	Yes	
	AF2288	H	Poly	ICC/IF, IHC, SW, WB	No	

8-HYDROXY-2'-DEOXYGUANOSINE

8-hydroxy-2'-deoxyguanosine (8-oxo-dG; 8-OHdG) is an oxidized derivative of deoxyguanosine and a major product of DNA oxidation. When its formation is induced by a DNA damaging agent, it is rapidly removed from DNA by the base excision repair pathway, and subsequently transported into saliva, urine and plasma. As such, levels of 8-oxo-dG are frequently used a marker of oxidative DNA damage.

Novus Biologicals™ and R&D Systems™ Antibodies						
MOLECULE	CATALOG #	SPECIES	CLONE	APPLICATIONS	CONJUGATES AVAILABLE	
8-OHdG	NB600-1508	H M	Poly	ELISA, ICC/IF, IHC	No	
8-oxo-dG	4354-MC-050	Ms	15A3	ELISA, ICC, IHC	No	

R&D Systems™ DNA Modifying Enzymes				
MOLECULE	SIZE	CATALOG #	SPECIES	SOURCE
OGG1 with Buffer	100 units	4130-100-EB	H	<i>E. coli</i>
	500 units	4130-500-EB	H	<i>E. coli</i>

R&D Systems™ ELISAs			
PRODUCT	CATALOG #	SPECIES	DESCRIPTION
HT 8-oxo-dG ELISA Kit II	4380-096-K	Ms	Measures 8-oxo-dG in plasma, urine, and saliva samples. Contains reagents needed for prepping DNA extracted from cultured cells, adherent cells, or tissue for use in assay.

Species Key: H Human, M Mouse, R Rat, Ms Multispecies, + Additional Species Available

Applications Key: ChIP Chromatin Immunoprecipitation, CyTOF CyTOF-Ready, ELISA Capture and/or Detection, Flow Cytometry, ICC/IF Immunocytochemistry/Immunofluorescence, IHC Immunohistochemistry, KO Knockout Validated, SW Simple Western™, WB Western blot

□ Indicates an R&D Systems brand antibody Δ Indicates a Novus Biologicals brand antibody

*Indicates a recombinant monoclonal antibody

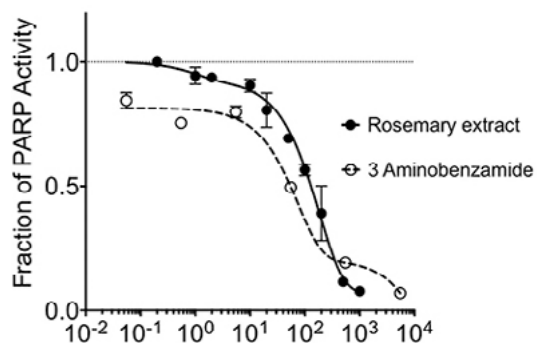
Learn more | rndsystems.com/products/dna-damage

PAR AND PARP

Poly (ADP-ribose) polymerases (PARPs) are a family of related enzymes that detect SS breaks in DNA and initiate the DNA damage repair response. Upon detection of a SS break, PARP binds to the DNA and begins generating a poly ADP-ribose (PAR) chain, which acts as a signal for other DNA repair enzymes. The synthesis of PAR requires cellular NAD⁺ as a substrate. After DNA repair is complete, the PAR chains are rapidly degraded by Poly-(ADP-ribose) Glycohydrolase (PARG). Inhibition of PARP activity is being investigated as a potential therapy for many diseases including cancer, inflammation, ischemia, and neurodegenerative disorders.

R&D Systems™ Assays		
PRODUCT	CATALOG #	DESCRIPTION
PARP Universal Colorimetric Assay	4677-096-K	Detect biotinylated PAR deposited by PARP onto immobilized histones. Colorimetric signal correlates with PARP activity. Ideal assay for <i>in vitro</i> screening of potential PARP inhibitors and determination of IC ₅₀ values.
PARP Universal Chemiluminescent Assay	4676-096-K	Detect biotinylated PAR deposited by PARP onto immobilized histones. Chemiluminescent signal correlates with PARP activity. Ideal assay for <i>in vitro</i> screening of potential PARP inhibitors and determination of IC ₅₀ values.
PARP/Apoptosis Colorimetric Assay	4684-096-K	An ELISA designed to measure <i>in vitro</i> activity of PARP in cell extracts. Detects PAR deposited by PARP onto immobilized histones. Colorimetric signal correlates with PARP activity. Ideal assay for <i>in vitro</i> screening of potential PARP inhibitors and determination of IC ₅₀ values.
PARP/Apoptosis Chemiluminescent Assay	4685-096-K	An ELISA designed to measure <i>in vitro</i> activity of PARP in cell extracts. Detects PAR deposited by PARP onto immobilized histones. Chemiluminescent signal correlates with PARP activity. Ideal assay for <i>in vitro</i> screening of potential PARP inhibitors and determination of IC ₅₀ values.
PARP Homogeneous Inhibition Assay	4690-096-K	High-throughput fluorescent screening assay for PARP inhibitors. Couples PARP autoribosylation to a fluorescent generating cycling assay.
PARP <i>In Vivo</i> Pharmacodynamic Assay II	4520-096-K	High-throughput chemiluminescent ELISA for quantification of PAR in cultured cells, PMCs, and tissue.

Novus Biologicals™ and R&D Systems™ Antibodies						
MOLECULE	CATALOG #	SPECIES	CLONE	APPLICATIONS	CONJUGATES AVAILABLE	
□ PAR/pADPr	4335-AMC-050	Ms	10HA	ELISA, IP, WB	No	
□ PAR/pADPr, with Control	4335-MC-100-AC	Ms	10HA	ELISA, IP, WB	No	
□ PAR/pADPr, without Control	4335-MC-100	Ms	10HA	ELISA, IP, WB	No	
□ PARP	4338-MC	H M R +	C2-10	ICC/IF, WB	No	
	MAB600	H M	53015	WB	No	
	△ NBP2-13732	H M R	Poly	ICC/IF, IHC, KD, WB	No	
	□ AF-600-NA	H M	Poly	ICC/IF, IP, KO, SW, WB	Yes	
△ PARP (Cleaved)	NB100-56599	H M R(-)	194C1439	Flow, Flow-IC, ICC/IF, WB	Yes	



***In Vitro* Analysis of PARP Inhibition by Rosemary Extract.** The effects of increasing concentrations of rosemary extract (filled circles) and 3-aminobenzamide (open circles), a known PARP inhibitor, on PARP activity was assessed *in vitro* using the PARP Universal Colorimetric Assay (R&D Systems, Catalog # 4677-096-K). Data adapted from Su, C. et al. (2017) *Sci. Rep.* 7:16704.

Species Key: H Human, M Mouse, R Rat, Ms Multispecies, + Additional Species Available

Applications Key: ELISA Capture and/or Detection, Flow Cytometry, Flow-IC Flow Cytometry (Intracellular), ICC/IF Immunocytochemistry/Immunofluorescence, IHC Immunohistochemistry, IP Immunoprecipitation, KD Knockdown Validated, KO Knockout Validated, SW Simple Western™, WB Western blot

□ Indicates an R&D Systems brand antibody △ Indicates a Novus Biologicals brand antibody

Learn more | rndsystems.com/products/dna-damage

PAR AND PARP, continued

R&D Systems™ Recombinant Enzymes				
MOLECULE	SIZE	CATALOG #	SPECIES	SOURCE
PARP (High Specific Activity)	1,000 units	4668-100-01	Ms	<i>E. coli</i>
	5,000 units	4668-500-01	Ms	<i>E. coli</i>
	20,000 units	4668-02K-01	Ms	<i>E. coli</i>

R&D Systems™ Purified PAR Polymers		
PRODUCT	SIZE	CATALOG #
PAR	100 µL	4336-100-01
Biotin(Terminal)-PAR	100 µL	4336-100-02

R&D Systems™ Ancillary Reagents		
PRODUCT	SIZE	CATALOG #
3-Aminobenzamide (200 mM)	60 µL	4667-50-03
PARP Treated Protein Control for Western Blot	10 µL	4500-10-P
PeroxyGlow A	6 mL	4675-096-01
PeroxyGlow B	6 mL	4675-096-02
Strep-Diluent (10X)	2 mL	4671-096-04

Tocris™ NAD ⁺ Substrates		
PRODUCT	CATALOG #	DESCRIPTION
Biotin-NAD ⁺	6573	Biotin-conjugated substrate for ADP-ribosylation. Convenient alternative to radiolabelled NAD ⁺ for use in PARP assays
Fluorescein-NAD ⁺	6574	Fluorescein-labeled substrate for ADP-ribosylation. Convenient alternative to radiolabelled NAD ⁺ for use in PARP assays

DNA MODIFYING ENZYMES AND SUPPLEMENTAL REAGENTS

Damaged DNA undergoes repair by various types of enzymes. Bio-Techne offers a variety of DNA repair enzymes for research in areas of base excision repair and oxidative damage, as well as thermophilic DNA polymerase Dpo4 for performing translesion synthesis for coupling to PCR for the amplification of damaged DNA. Bio-Techne also has three types of highly purified genomic DNA that are qualified for Northern blot, Southern blot, probe array, and dot blotting procedures.

R&D Systems™ DNA Modifying Enzymes				
MOLECULE	SIZE	CATALOG #	SPECIES	SOURCE
OGG1 with Buffer	100 units	4130-100-EB	H	<i>E. coli</i>
	500 units	4130-500-EB	H	<i>E. coli</i>
Benzonase Nuclease/NucA	20 µg	140038-NA-020	<i>S. marcescens</i>	<i>E. coli</i>
	100 µg	140038-NA-100	<i>S. marcescens</i>	<i>E. coli</i>
Fpg with Buffer	500 units	4040-100-EB	<i>E. coli</i>	<i>E. coli</i>
	2,500 units	4040-500-EB	<i>E. coli</i>	<i>E. coli</i>
Histone Deacetylase 8/HDAC8	50 µg	4359-DA-050	H	<i>Sf</i> 21
PARP (High Specific Activity)	1,000 units	4668-100-01	Ms	<i>E. coli</i>
	5,000 units	4668-500-01	Ms	<i>E. coli</i>
	20,000 units	4668-02K-01	Ms	<i>E. coli</i>
Sirtuin 1/SIRT1	50 µg	7714-DA-050	H	<i>E. coli</i>
Sirtuin 2/SIRT2	50 µg	4358-DA-050	H	<i>Sf</i> 21
Sirtuin 3/SIRT3	50 µg	7488-DA-050	H	<i>E. coli</i>
Sleeping Beauty Transposase	200 µg	4469-TP-200	Viral	<i>E. coli</i>

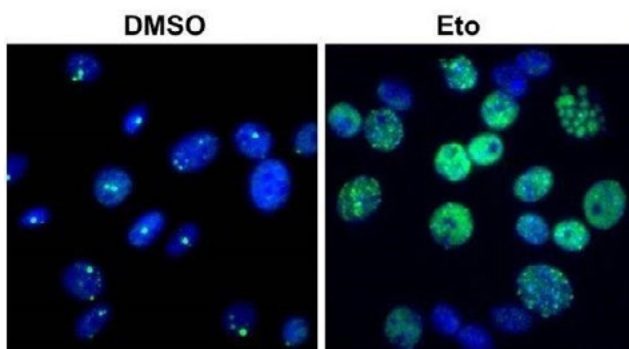
Species Key: H Human, Ms Multispecies

Source Key: *Sf* (*Spodoptera frugiperda*)

ANTIBODIES

Antibodies are a versatile tool for detecting and analyzing DNA damage in individual cells. Bio-Techne offers antibodies through its R&D Systems and Novus Biologicals brands that will recognize and bind to a variety of DNA adducts induced by different genotoxic agents, as well as to markers of DNA damage such as γ H2AX. These antibodies can be used to evaluate DNA damage and repair by multiple methods including Western blot, immunofluorescence, and flow cytometry.

Novus Biologicals™ and R&D Systems™ Antibodies						
MOLECULE	CATALOG #	SPECIES	CLONE	APPLICATIONS	CONJUGATES AVAILABLE	
△	53BP1	NBP2-54753*	H M R +	1285C	Flow, Flow-IC, ICC/IF, IHC, WB	Yes
△		NB100-304	H M R +	Poly	ChIP, Flow, Flow-IC, IB, ICC/IF, IHC, IP, KD, KO, WB	Yes
□		AF1877	H	Poly	IHC, KO, WB	No
△	8-OHdG	NB600-1508	H M	Poly	ELISA, ICC/IF, IHC	No
□	8-oxo-dG	4354-MC-050	Ms	15A3	ELISA, ICC, IHC	No
△	ATM	NB100-309	H M R +	2C1	ChIP, ELISA, Flow, ICC/IF, IHC, KD, SCW, WB	No
□		MAB22901	H	664703	ICC/IF	No
△		NB100-104	H M R +	Poly	ELISA, Flow, IB, ICC/IF, IHC, IP, WB	Yes
△	Phospho-ATM (S1981)	NB100-306	H M R Ca(-)	10H11.E12	ICC/IF, IHC, IP, WB	Yes
□		AF1655	H M R	Poly	SW, WB	No
△	ATR	NB100-308	H M	2B5	FA, ICC/IF, IP, WB	No
□		AF4717	H	Poly	IHC, WB	No
△	Phospho-ATR (T1989)	NBP2-43564	H	222	IP, WB	No
△	ATRIP	NBP2-02004	H +	OT15E7	Flow, ICC/IF, IHC, WB	Yes
□		AF1579	H	Poly	SW, WB	No
△	BRCA1	NBP1-41185	H M	17F8	ChIP, ELISA, ICC/IF, IHC, IP, WB	No
△		NB100-598	H	RAY	CyTOF, Flow, ICC/IF, IP, WB	Yes
□	BRCA1 (N-Terminus)	AF2210	H	Poly	IHC, IP, WB	No
□	BRCA1 (C-Terminus)	MAB22101	H M	440621	IHC, WB	No
△	Phospho-BRCA1 (S1423)	NB100-226	H +	Poly	Flow, WB	No
□		AF1386	H	Poly	ICC/IF, WB	No
△	Phospho-BRCA1 (S1524)	NB100-200	H	Poly	IP, WB	No
□	BRCA2	MAB2476	H	234403	IHC, WB	No
△		NBP1-88361	H	Poly	Flow, ICC/IF, WB	No
△	Chk1	NB100-1768	H	2G1D5	ICC/IF, IHC, WB	Yes
△		NBP2-67541*	H M	ST57-09	Flow, ICC/IF, IHC, WB	No
□		AF1630	H M R	Poly	IP, WB	No
□	Phospho-Chk1 (S317)	AF2054	H M R	Poly	SW, WB	No
△		NBP2-37703	H	Poly	IHC, IP, WB	No
□	Phospho-Chk1 (S345)	AF2475	H	Poly	WB	No
△	Chk2	NB100-56546	H M	73C175.1.1	Flow, ICC/IF, IHC, WB	Yes
□	Phospho-Chk2 (T68)	MAB1626*	H	1238H	ICC/IF, WB	No
△	DDB1	NBP2-75465*	H M R	JU32-35	ICC/IF, IHC, IP, WB	No
△		NBP1-33061	H M R +	Poly	ICC/IF, IHC, IP, WB	No



53BP1 in C8D1A Mouse Cell Line. The C8D1A mouse astrocyte cell line was treated with the DNA damaging agent etoposide (Eto) or DMSO for 48 hours. 53BP1 was detected in fixed cells using a Rabbit Anti-Human/Mouse/Rat 53BP1 Antigen Affinity-Purified Polyclonal Antibody (Novus Biologicals, Catalog # NB100-304). The cells were stained green and then counterstained with DAPI (blue).

Learn more | novusbio.com/research-areas/cancer/dna-repair

MOLECULE	CATALOG #	SPECIES	CLONE	APPLICATIONS	CONJUGATES AVAILABLE
XPE/DDB2	NBP2-75718*	H	JE16-41	Flow, IHC, WB	No
	AF3297	H	Poly	WB	No
DNA-PKcs	NBP2-22128	H M	3H6	ELISA, ICC/IF, IHC, WB	No
	NB100-658	H	Poly	IP, WB	No
DNA Polymerase- κ	NBP2-57385	H M R	Poly	ICC/IF	No
	NBP2-55247	H	Poly	ICC/IF, WB	No
FANCD2	NBP2-61930	H M R	1290C	KO, WB	Yes
	MAB9369*	H	1290D	Flow, IHC, KO, SW, WB	Yes
GADD45 α	NBP2-55059	H M	Poly	ICC/IF	No
	NBP2-45806	H	OT11C9	WB	Yes
	AF5510	H	Poly	WB	No
Histone H2AX	MAB3406	H M R	322105	ICC/IF, WB	No
	NB100-638	H M	Poly	ICC/IF, IHC, KO, WB	Yes
Phospho-Histone H2AX (S139; γ H2AX)	4418-APC-100	Ms	Poly	ICC/IF, WB	No
	NB100-384	H M R +	Poly	ChIP, Flow, ICC/IF, IHC, KO, SW, WB	Yes
	MAB2288*	H	2207D	CyTOF, Flow, WB	Yes
	AF2288	H	Poly	ICC/IF, IHC, SW, WB	No
Ku70/XRCC6	NB100-1915	H M R +	N3H10	Flow, ICC/IF, IHC, IP, WB	No
	NBP2-38954	H M R	Poly	ICC/IF, IHC, WB	No
	AF5597	H	Poly	WB	No
Ku80/XRCC5	NBP2-37583	H M	5C5	ELISA, Flow, ICC/IF, IHC, WB	No
	NBP1-87829	H R	Poly	ICC/IF, IHC, WB	No
	NBP1-56408	H	Poly	ICC/IF, IHC, WB	No
MGMT	NB100-168	H M(-)	MT 23.2	CyTOF, Flow, Flow-IC, ICC/IF, IHC, SW, WB	Yes
	AF3794	H	Poly	WB	No
	MAB3299	M	300008	WB	No
MLH1	NBP2-67381	H M R	SP08-04	Flow, ICC/IF, IHC, IP, WB	No
	NB100-56552	H M +	164C819	WB	Yes
Mre11	NB100-473	H M R	12D7	ELISA, FA, ICC/IF, IHC, IP, KD, PLA, WB	No
	NB100-142	H M R +	Poly	ChIP, Flow, IB, ICC/IF, IHC, IP, KD, SW, WB	No
MSH2	NB100-621	H M	Poly	IHC, IP, WB	No
Nbs1	NB100-221	H M R	1D7	ICC/IF, IHC, IP, KD, SW, WB	No
	MAB1573	H M R	206919	KO, WB	No
	NB100-143	H M R +	Poly	ChIP, Flow, IB, ICC/IF, IHC, IP, ISH, PAGE, KO, WB	No
Phospho-Nbs1 (S343)	AF4944	H	Poly	WB	No
NTH1	MAB2675	H	208521	WB	No
	NB100-108	H M R +	Poly	ICC/IF, IHC, WB	Yes
OGG1	NBP2-52724	H	2B4	Flow, Flow-IC, ICC/IF, IHC	Yes
	NB100-106	H M R +	Poly	ELISA, Flow, Flow-IC, IB, ICC/IF, IHC, IP, WB	Yes



Boost Your Protein Analysis Throughput with Simple Western

Unlike traditional Western blot, Simple Western instruments provide the throughput options you need to screen proteins. With options of 13, 25, or 96 samples per run, get the result you need, fast.



Novus Biologicals™ and R&D Systems™ Antibodies

MOLECULE	CATALOG #	SPECIES	CLONE	APPLICATIONS	CONJUGATES AVAILABLE
p53	NB200-103	H M R +	PAb 240	CyTOF, ELISA, Flow, Flow-IC, ICC/IF, IHC, IP, WB	Yes
	MAB1355	H M R	184721	ICC/IF, IP, WB	No
	AF1355	H M R	Poly	ChIP, ICC/IF, IP, KO, SW, WB	Yes
Phospho-p53 (S15)	NB200-171	H	Poly	CHIP-SEQ, Flow, IHC, IP, KD, WB	Yes
	MAB1839	H	261352	CyTOF, Flow, WB	Yes
	NB100-1913	H M R	Poly	ICC/IF, IHC, IP, WB	No
PAR/pADPr	AF1043	H	Poly	ICC/IF, IHC, IP, WB	No
	4335-AMC-050	Ms	10HA	ELISA, IP, WB	No
PAR/pADPr, with Control	4335-MC-100-AC	Ms	10HA	ELISA, IP, WB	No
PAR/pADPr, without Control	4335-MC-100	Ms	10HA	ELISA, IP, WB	No
PARP	4338-MC	H M R +	C2-10	ICC/IF, WB	No
	MAB600	H M	53015	WB	No
	NBP2-13732	H M R	Poly	ICC/IF, IHC, KD, WB	No
	AF-600-NA	H M	Poly	ICC/IF, IP, KO, SW, WB	Yes
PARP (Cleaved)	NB100-56599	H M R (-)	194C1439	Flow, Flow-IC, ICC/IF, WB	Yes
PMS2	NBP2-46459	H	OTI2G5	ICC/IF, IHC, WB	Yes
	NB100-56554	H M	163C1251	CyTOF, Flow, IHC, WB	Yes
	NBP2-58488	H M R	Poly	ICC/IF, WB	No
Rad23	NBP2-52549	H	3E3F4	CyTOF, ELISA, Flow, IHC, WB	No
	NBP1-49977	H M	Poly	IHC, IP, WB	No
	AF4555	H M R +	Poly	WB	No
Rad50	MAB4996	H	684945	WB	No
	NB100-147	H M R +	13B3	ICC/IF, IHC, IP, IVT, KD, WB	No
	NB100-154	H M +	Poly	IP, SW, WB, ICC/IF(-)	No
	AF4996	H	Poly	WB	No
Rad51	NB100-148	H M R +	14B4	ChIP, ICC/IF, IHC, IP, IVT, KD, PLA, WB	No
	NB100-499	H M	13E4	IHC, WB	No
	MAB99481	H	523713	ICC/IF, IHC	Yes
RPA2	NB600-565	H	9H8	ICC/IF, IHC, IP, WB	No
	NB100-332	H M	Poly	IHC, IP, WB	No
Phospho-RPA2 (S4, S8)	NBP1-23017	H M +	Poly	ICC/IF, IHC, IP, KD, WB	Yes
Phospho-RPA2 (T21)	NBP2-67654	H M R	SN06-36	IP, WB	No
	AF6654	H	Poly	WB	No
Phospho-RPA2 (S33)	NB100-544	H +	Poly	ICC/IF, WB	Yes
TERT	NB100-317	H M	2C4	ChIP, Flow, ICC/IF, IHC, IP, WB	No
	NB100-89471	H M +	Poly	ICC/IF, WB	Yes
XPA	NBP2-50600	H	2A4	ICC/IF, IHC, WB	Yes
	NBP2-58708	H M R	Poly	ICC/IF	No
XPG	NBP2-50366	H	8H7/XPG	CyTOF, ELISA, Flow, ICC/IF, IHC, IP, WB	Yes
	NB100-74611	H	Poly	IHC, IP, WB	No

Species Key: H Human, M Mouse, R Rat, Ca Canine, Ms Multispecies, + Additional Species Available

Applications Key: ChIP Chromatin Immunoprecipitation, **ChIP-SEQ** Chromatin Immunoprecipitation Sequencing, **CyTOF** CyTOF-Ready, **ELISA** Capture and/or Detection, **FA** Functional Assay, **Flow** Cytometry, **Flow-IC** Flow Cytometry (Intracellular), **IB** Immunoblotting, **ICC/IF** Immunocytochemistry/Immunofluorescence, **IHC** Immunohistochemistry, **IP** Immunoprecipitation, **ISH** *In Situ* Hybridization, **IVT** *In Vitro*, **KD** Knockdown Validated, **KO** Knockout Validated, **PAGE** SDS-PAGE, **PLA** Proximity Ligation Assay, **RNAi** RNA Inhibition, **SCW** Single Cell Western, **SW** Simple Western™, **WB** Western blot

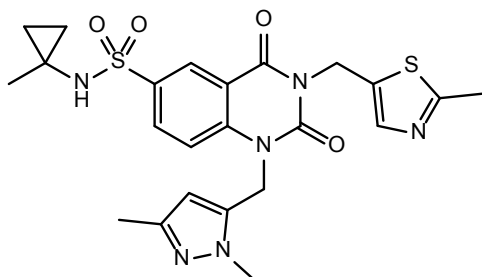
□ Indicates an R&D Systems brand antibody ▲ Indicates a Novus Biologicals brand antibody

*Indicates a recombinant monoclonal antibody

SMALL MOLECULES

A comprehensive understanding of DNA repair mechanisms is essential in order to understand how aberrant activity of these pathways, which can lead to genome destabilization and cell death, is triggered. However, these DNA repair pathways are complex and require the functional interactions of multiple proteins. Pharmacologically inhibiting the proteins involved in DNA repair allows these intricate DNA repair networks to be dissected for a better understanding of the interconnections of the different DNA repair networks. Bio-Techne offers Tocris™ highly pure small molecules for inhibiting different components of DNA repair mechanisms.

Tocris™ Small Molecules		
CATALOG #	PRODUCT NAME	DESCRIPTION
3544	KU 55933	Potent, selective and competitive ATM kinase inhibitor; acts as a radio- and chemosensitizer for the treatment of cancer.
6346	PF 5006739	Potent Casein Kinase 1δ/ε inhibitor; mediates circadian rhythm phase-delaying effects <i>in vivo</i> .
5329	CKI 7 dihydrochloride	Casein Kinase 1 (CK1) inhibitor; also inhibits SGK, S6K1 and MSK1. Induces retinal cell differentiation from human ESCs and iPSCs in combination with SB 431542 (Catalog # 1614) and Y-27632 (Catalog # 1254).
5342	SCR7 pyrazine	Enhances CRISPR-Cas9-mediated homology-directed repair (HDR) efficiency <i>in vitro</i> up to 19-fold. Inhibits nonhomologous end-joining (NHEJ).
3712	NU 7441	Potent and selective DNA-PK inhibitor; selective for DNA-PK over a range of kinases including mTOR, PI 3-K, ATM and ATR. Also enhances CRISPR-Cas9-mediated HDR efficiency 2 to 3-fold.
3984	Nutlin-3	MDM2 antagonist; inhibits the MDM2-p53 interaction and activates p53. Induces apoptosis in cancer cells.
3710	PRIMA-1MET	Methylated derivative of PRIMA-1 (Catalog # 1862); restores mutant p53 activity.
5284	trans-ISRIB	Integrated stress response (ISR) inhibitor; reverses the effects of eIF2α phosphorylation and restores cell translation capacity.
4459	TC-S 7005	Potent and selective Polo-like Kinase 2 (PLK2) inhibitor; induces mitotic arrest and cell death in HCT 116 colorectal cells.
5690	Centrinone B	High affinity and selective PLK4 inhibitor; exhibits >2000-fold selectivity for PLK4 over Aurora A and Aurora B. Induces cell cycle arrest in normal human cell lines in a p53-dependent manner.
3255	PJ 34 hydrochloride	Potent inhibitor of Poly (ADP-ribose) Polymerase (PARP) ; protects primary neuronal cells from oxygen-glucose deprivation <i>in vitro</i> and reduces infarct size following focal cerebral ischemia.
3748	XAV 939	Potent Tankyrase (TNKS) inhibitor; antagonizes Wnt signaling via stimulation of β-catenin degradation and stabilization of Axin. Inhibits proliferation of the β-catenin-dependent colon carcinoma cell line DLD-1.
4106	Nicotinamide	Inhibitor of PARP-1 enzymes; NAD ⁺ precursor. Promotes differentiation of mesenchymal stem cells to insulin producing cells when used in combination with growth factors and high glucose concentration.
5952	PDD 00017273	Potent and selective Poly (ADP ribose) Glycohydrolase (PARG) inhibitor. Maintains PAR chains and induces DNA double-stranded breaks in cells following DNA damage.
7007	PDD 00017238	High affinity and potent PARG inhibitor
6867	Rhein	FTO (mRNA N ⁶ -Methyladenine Demethylase) inhibitor; competitively binds enzyme at active site preventing binding of N ⁶ -methyladenosine (m ⁶ A) substrate and resulting in accumulation of DNA damage in cells.
2624	Decitabine	DNA Methyltransferase inhibitor; cytosine analog that is incorporated into DNA and acts as a suicide substrate for DNA methyltransferase.
3295	RG 108	Non-nucleoside DNA Methyltransferase inhibitor that blocks the enzyme active site. Inhibits DNA methylation in human cancer cell lines <i>in vitro</i> without detectable toxicity. Demethylates and reactivates epigenetically silenced tumor suppressor genes.
6573	Biotin-NAD ⁺	Biotinylated-NAD ⁺ ; substrate for ADP-ribosylation; used to measure PARP activity. Can also be used to label and purify biotinyl-ADP ribosylated proteins.
5419	PCNA 11	Proliferating Cell Nuclear Antigen (PCNA) inhibitor. Directly binds PCNA trimers, reduces chromatin-associated PCNA in cells, inhibits cell growth through induction of S and G2M arrest, and attenuates DNA replication in cells.
5334	TH 588	Potent MTH1 inhibitor; induces oxidative DNA damage and reduces survival in cancer cells.
1867	NSC 663284	Potent, selective inhibitor of Cdc25 dual specificity phosphatases; exhibits selectivity over VHR and PTP1B phosphatases. Arrests cells at both G ₁ and G ₂ /M phase and blocks Cdk2 and Cdk1 activation.



Potent and Selective PARG Inhibitor. PDD 00017273 (Tocris, Catalog # 5952) is a potent and cell permeable PARG inhibitor that exhibits > 350-fold selectivity for PARG over PARP1, ARH3, and other ion channels, enzymes and receptors. This compound maintains PAR chains and induces DS breaks in cells following DNA damage.

Learn more | tocris.com/cell-biology/cell-cycle



WHERE SCIENCE
INTERSECTS INNOVATION™

bio·techne®

bio-techne.com

R&D SYSTEMS

**NOVUS
BIOLOGICALS**

TOCRIS

protein**simple**

A&D

Global info@bio-techne.com bio-techne.com/find-us/distributors TEL +1 612 379 2956 North America TEL 800 343 7475
Europe | Middle East | Africa TEL +44 (0)1235 529449 China info.cn@bio-techne.com TEL +86 (21) 52380373

For research use or manufacturing purposes only. Trademarks and registered trademarks are the property of their respective owners.

BR_DNA Damage_RSDFY20-14810