

## Litron Laboratories MultiFlow® DNA Damage Assay Dataset for EMGS Bioinformatics Challenge 2020

See: Bryce SM, Bernacki DT, Bemis JC, Dertinger SD. Genotoxic mode of action predictions from a multiplexed flow cytometric assay and a machine learning approach. *Environ Mol Mutagen.* 2016 Apr;57(3):171-89.

Link to Publication: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4792721/>

This is an open access article that contains a Supplementary File 2 (see Associated Data) with all the raw flow cytometric data associated with the analysis of the compounds found in the following Table. Please access this file to obtain the data for use in the Bioinformatics Challenge. If you have any questions, contact [jbemis@litronlabs.com](mailto:jbemis@litronlabs.com).

Chemical	CAS No.	<i>a priori</i> Classification; notes	References
AMG 900	945595-80-2	Aneugen; pan-Aurora kinase inhibitor; top conc. 0.1 µM	Payton <i>et al.</i> , 2010
Carbendazim	10605-21-7	Aneugen; mitotic spindle poison	Van Hummelen <i>et al.</i> , 1995
Colchicine	64-86-8	Aneugen; mitotic spindle poison; top conc. 0.1 µM	Kirkland <i>et al.</i> , 2015
Diethylstilbestrol	56-53-1	Aneugen; synthetic estrogen	Elhajouji <i>et al.</i> , 1997
Griseofulvin	126-07-8	Aneugen; mitotic spindle poison	Oliver <i>et al.</i> , 2006
Mebendazole	31431-39-7	Aneugen; mitotic spindle poison; top conc. 10 µM	Van Hummelen <i>et al.</i> , 1995
Nocodazole	31430-18-9	Aneugen; top conc. 10 µM	Attia, 2013
Noscapine	128-62-1	Aneugen; mitotic spindle poison	Schuler <i>et al.</i> , 1999
Paclitaxel	33069-62-4	Aneugen; mitotic spindle poison; top conc. 1 µM	Kirkland <i>et al.</i> , 2015
Vinblastine sulfate	143-67-9	Aneugen; mitotic spindle poison; top conc. 0.01 µM	Kirkland <i>et al.</i> , 2015
17β-Estradiol	50-28-2	Aneugen; steroid hormone	Hernández <i>et al.</i> , 2013
Fisetin	345909-34-4	Aneugen; Aurora B kinase inhibitor; clastogenic properties reported at high concentrations that are attributed to topoisomerase II inhibition	Olaharski <i>et al.</i> , 2005; Gollapudi <i>et al.</i> , 2014
Flubendazole	31430-15-6	Aneugen; inhibits tubulin polymerization	Tweats <i>et al.</i> , 2015
Vincristine sulfate		Aneugen; mitotic spindle poison	Kondo <i>et al.</i> , 1992

4-Nitroquinoline 1-oxide	56-57-5	Clastogen; likely several modes of action that may include ROS; top conc. 10 $\mu$ M	Kirkland <i>et al.</i> , 2015
5-Fluorouracil	51-21-8	Clastogen; anti-metabolite	Kirkland <i>et al.</i> , 2015
Aphidicolin	38966-21-1	Clastogen; DNA polymerase inhibitor; top conc. 10 $\mu$ M	Glover <i>et al.</i> , 1984
Azathioprine	446-86-6	Clastogen; prodrug of mercaptopurine, purine analog	Henderson <i>et al.</i> , 1993
Azidothymidine	30516-87-1	Clastogen; nucleoside analog	Kirkland <i>et al.</i> , 2015
Camptothecin	7689-03-4	Clastogen; topoisomerase I inhibitor; top conc. 0.1 $\mu$ M	Attia <i>et al.</i> , 2009
Chlorambucil	305-03-3	Clastogen; nitrogen mustard-type alkylator; top conc. 100 $\mu$ M	Dertinger <i>et al.</i> , 2012
Cisplatin	15663-27-1	Clastogen; atypical alkylator; prepared immediately before use	Kirkland <i>et al.</i> , 2015
Cytosine arabinoside	147-94-4	Clastogen; anti-metabolite; top conc. 10 $\mu$ M	Kirkland <i>et al.</i> , 2015
Ethyl methanesulfonate	62-50-0	Clastogen; alkylator	Gocke <i>et al.</i> , 2009
Etoposide	33419-42-0	Clastogen; topoisomerase II inhibitor; top conc. 10 $\mu$ M	Kirkland <i>et al.</i> , 2015
Methyl methanesulfonate	66-27-3	Clastogen; alkylator	Kirkland <i>et al.</i> , 2015
Hydralazine HCl	304-20-1	Clastogen; prepared in RPMI medium	Martelli <i>et al.</i> , 1995
Hydrogen peroxide	7722-84-1	Clastogen; ROS; prepared in RPMI medium immediately before use	Kimura <i>et al.</i> , 2013
Hydroxyurea	127-07-1	Clastogen; anti-metabolite, ribonucleotide reductase inhibitor	Dertinger <i>et al.</i> , 2012
Melphalan	142-82-3	Clastogen; nitrogen mustard-type alkylator	Dertinger <i>et al.</i> , 2012
Menadione	58-27-5	Clastogen; ROS implicated	Cojocel <i>et al.</i> , 2006
Methotrexate	59-05-2	Clastogen; anti-metabolite; top conc. 10 $\mu$ M	Keshava <i>et al.</i> , 1998
Methyl methanesulfonate	66-27-3	Clastogen; alkylator	Kirkland <i>et al.</i> , 2015
Mitomycin C	50-07-7	Clastogen; DNA cross-linker; top conc. 10 $\mu$ M	Kirkland <i>et al.</i> , 2015

N-Ethyl-N-nitrosourea	759-73-9	Clastogen; alkylator	Kirkland <i>et al.</i> , 2015
Temozolomide	85622-93-1	Clastogen; alkylator	Chinnasamy <i>et al.</i> , 1997
Thiotepa	52-24-4	Clastogen; alkylator	Dertinger <i>et al.</i> , 2012
Topotecan	123948-87-8	Clastogen; topoisomerase I inhibitor; top conc. 0.1 $\mu$ M	Aydemir and Bilaloğlu, 2003
1,3-Propane sultone	1120-71-4	Clastogen; alkylator	Dertinger <i>et al.</i> , 2011
2-Acetylaminofluorene	53-96-3	Clastogen with rat liver S9	Kirkland <i>et al.</i> , 2015
7,12-Dimethylbenzanthracene	57-97-6	Clastogen with rat liver S9	Kirkland <i>et al.</i> , 2015
Benzo[a]pyrene	50-32-8	Clastogen with rat liver S9	Kirkland <i>et al.</i> , 2015
Bleomycin sulfate	9041-93-4	Clastogen; radiomimetic	
Cyclophosphamide monohydrate	6055-19-2	Clastogen with rat liver S9	Kirkland <i>et al.</i> , 2015
Glycidamide	5694-00-8	Clastogen; major <i>in vivo</i> metabolite of acrylamide	Paulsson <i>et al.</i> , 2003
Lynparza™ (Olaparib)	763113-22-0	Clastogen; PARP inhibitor	FDA approved label
Amitrole	61-82-5	Non-genotoxicant	Kirkland <i>et al.</i> , 2015
Anthranilic acid	118-92-3	Non-genotoxicant	Kirkland <i>et al.</i> , 2015
Brefeldin A	20350-15-6	Non-genotoxicant; ER-golgi transporter inhibitor, ER stress-induced apoptosis; top conc. 10 $\mu$ M	Moon <i>et al.</i> , 2012
Caffeine	58-08-2	Non-genotoxicant; mitochondria-dependent apoptosis, ROS involvement likely	Lu <i>et al.</i> , 2008
Carbonyl cyanide m-chlorophenyl hydrazone (CCCP)	555-60-2	Non-genotoxicant; uncoupler of oxidative phosphorylation; top conc. 100 $\mu$ M	de Graaf <i>et al.</i> , 2004
Clofibrate	637-07-0	Non-genotoxicant; antilipidemic agent	IARC monograph
Cyclohexanone	108-94-1	Non-genotoxicant; industrial chemical	Kirkland <i>et al.</i> , 2008
Cycloheximide	66-81-9	Non-genotoxicant; protein synthesis inhibitor; top conc. 100 $\mu$ M	Youngblom <i>et al.</i> , 1989
D-Mannitol	69-65-8	Non-genotoxicant; polyol	Kirkland <i>et al.</i> , 2015

Dexamethasone	50-02-2	Non-genotoxicant; glucocorticoid receptor agonist	Krishna <i>et al.</i> , 1995
Dextrose	50-99-7	Non-genotoxicant; sugar	Lotz <i>et al.</i> , 2009
Di-(2-ethylhexyl)phthalate (DEHP)	117-81-7	Non-genotoxicant; organic plasticizer	Kirkland <i>et al.</i> , 2015
Diethanolamine	111-42-2	Non-genotoxicant; secondary amine	Kirkland <i>et al.</i> , 2015
Erythromycin	114-07-8	Non-genotoxicant; antibiotic	Kirkland <i>et al.</i> , 2015
Pepcid® (Famotidine)	76824-35-6	Non-genotoxicant; histamine H <sub>2</sub> receptor antagonist	FDA approved label
Gleevec® (imatinib mesylate)	152459-95-5	Non-genotoxicant; protein-tyrosine kinase inhibitor	FDA approved label
Hexachloroethane	67-72-1	Non-genotoxicant; industrial chemical	Kirkland <i>et al.</i> , 2015
Lidoderm® (Lidocaine)	137-58-6	Non-genotoxicant; amide local anesthetic	FDA approved label
Mevacor® (Lovastatin)	75330-75-5	Non-genotoxicant; HMG-CoA reductase inhibitor	FDA approved label
Melamine	108-78-1	Non-genotoxicant: industrial organic base	Kirkland <i>et al.</i> , 2015
Methyl carbamate	598-55-0	Non-genotoxicant; industrial intermediate	Kirkland <i>et al.</i> , 2015
<i>N</i> -Butyl chloride	109-69-3	Non-genotoxicant; fumigant	Kirkland <i>et al.</i> , 2015
Floxin® (Ofloxacin)	82419-36-1	Non-genotoxicant; fluoroquinolone antibiotic; top conc. 500 µM due to solubility	FDA approved label
Paxil® (Paroxetine)	61869-08-7	Non-genotoxicant; SSRI antidepressant	FDA approved label
Phenanthrene	85-01-8	Non-genotoxicant; polycyclic aromatic hydrocarbon	Kirkland <i>et al.</i> , 2008
Phenformin HCl	834-28-6	Non-genotoxicant; biguanide antidiabetic	Kirkland <i>et al.</i> , 2015
Progesterone	57-83-0	Non-genotoxicant; steroid hormone	Kirkland <i>et al.</i> , 2008
Pyridine	110-86-1	Non-genotoxicant; heterocyclic organic compound	Kirkland <i>et al.</i> , 2015

Sodium chloride	7647-14-5	Non-genotoxicant; prepared in RPMI medium	Matsushima <i>et al.</i> , 1999
Sodium dodecyl sulfate	151-21-3	Non-genotoxicant; ionic detergent	NTP website
Sucrose	57-50-1	Non-genotoxicant	Diaz <i>et al.</i> , 2007
Tert-butyl alcohol	75-65-0	Non-genotoxicant	Kirkland <i>et al.</i> , 2015
Thapsigargin	67526-95-8	Non-genotoxicant; ER stress-induced apoptosis	Futami <i>et al.</i> , 2005
Tunicamycin	11089-65-9	Non-genotoxicant; glycosylation inhibitor, ER stress-mediated apoptosis; top conc. 500 $\mu$ M due to solubility	Han <i>et al.</i> , 2008
Alosetron HCl	122852-42-0	Non-genotoxicant; 5-HT <sub>3</sub> antagonist; top conc. 250 $\mu$ M due to solubility	Kirkland <i>et al.</i> , 2015
D-Limonene	5989-27-5	Non-genotoxicant; male rat kidney tumors due to $\alpha$ 2 $\mu$ -globulin nephropathy	Kirkland <i>et al.</i> , 2015
Nutlin-3	548472-68-0	Non-genotoxicant; inhibitor of Mdm2 and p53 interaction, stabilizes p53,	Secchiero <i>et al.</i> , 2006
Tolterodine L-tartrate	124937-52-6	Non-genotoxicant; muscarinic receptor antagonist	Kirkland <i>et al.</i> , 2015
Zonisamide	68291-97-4	Non-genotoxicant; sulfonamide anticonvulsant	Kirkland <i>et al.</i> , 2015

### **Additional articles reporting on MultiFlow and genotoxic Mode of Action predictions.**

Dertinger SD, Kraynak AR, Wheeldon RP, Bernacki DT, Bryce SM, Hall N, Bemis JC, Galloway SM, Escobar PA, Johnson GE. Predictions of genotoxic potential, mode of action, molecular targets, and potency via a tiered multiflow® assay data analysis strategy. *Environ Mol Mutagen.* 2019 Jul;60(6):513-533.

Bryce SM, Bernacki DT, Smith-Roe SL, Witt KL, Bemis JC, Dertinger SD. Investigating the Generalizability of the MultiFlow ® DNA Damage Assay and Several Companion Machine Learning Models With a Set of 103 Diverse Test Chemicals. *Toxicol Sci.* 2018 Mar 1;162(1):146-166.

Bryce SM, Bernacki DT, Bemis JC, Spellman RA, Engel ME, Schuler M, Lorge E, Heikkinen PT, Hemmann U, Thybaud V, Wilde S, Queisser N, Sutter A, Zeller A, Guérard M, Kirkland D,

Dertinger SD. Interlaboratory evaluation of a multiplexed high information content in vitro genotoxicity assay. *Environ Mol Mutagen.* 2017Apr;58(3):146-161.

Bernacki DT, Bryce SM, Bemis JC, Kirkland D, Dertinger SD.  $\gamma$ H2AX and p53 responses in TK6 cells discriminate promutagens and nongenotoxicants in the presence of rat liver S9. *Environ Mol Mutagen.* 2016 Aug;57(7):546-558.