



UKEMS Young Scientist

Mike Burgum
Research Officer
In Vitro Toxicology Group
Swansea University

The CHIASMA Project has received funding from:



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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Education,
Research and Innovation SERI



National Research
Foundation of Korea



UK Research
and Innovation

A big thank you!

- UKEMS Scientific Committee
- Professors Gareth Jenkins & Shareen Doak
- IVTG Team at Swansea



A reminder to enjoy what we do

The mind is a chaos of delight

–Charles Darwin, 1832

-
- PhD
 - Nanomaterials
 - Genetic toxicology
 - Postdoctoral research
 - RiskGONE & NanoInformaTIX
 - CHIASMA
 - Collaborations
 - Short case study on PFAS

Journey to UKEMS Young Scientist 2026



2024 Amy Wilson
2022 Helena Reinardy
2020 Katherine Chapman
2018 Rhiannon David
2016 Jill Kucab
2014 Sabine Langie
2012 George Johnson
2010 Catherine Prestley
2008 Shareen Doak
2006 Karen Brown
2004 Volker Arlt
2002 Gareth Jenkins
2000 Frank Martin
1998 Anthony Lynch
1996 Valerie McKelvey-Martin



2011



BSc
Biochemistry

MSc
Nanomedicine



2014



2015



PhD Genetic
Toxicology

Research
Officer



2019



PhD Research

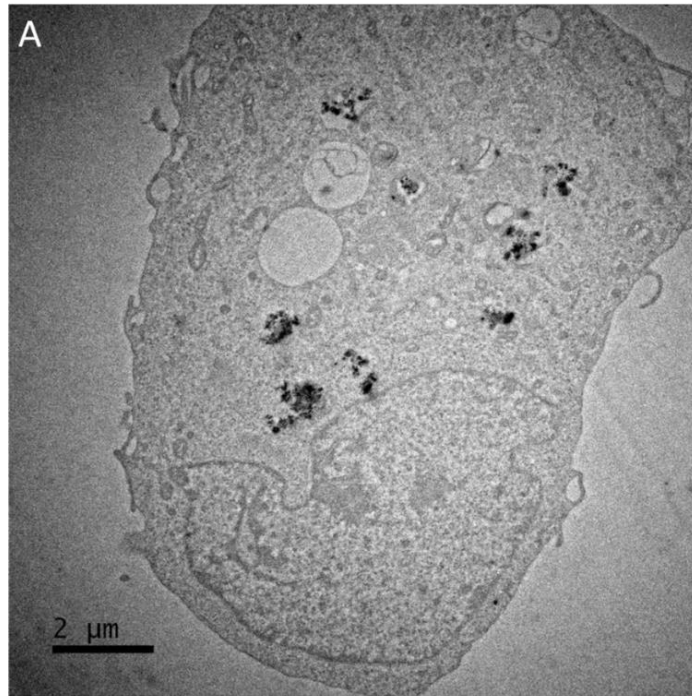
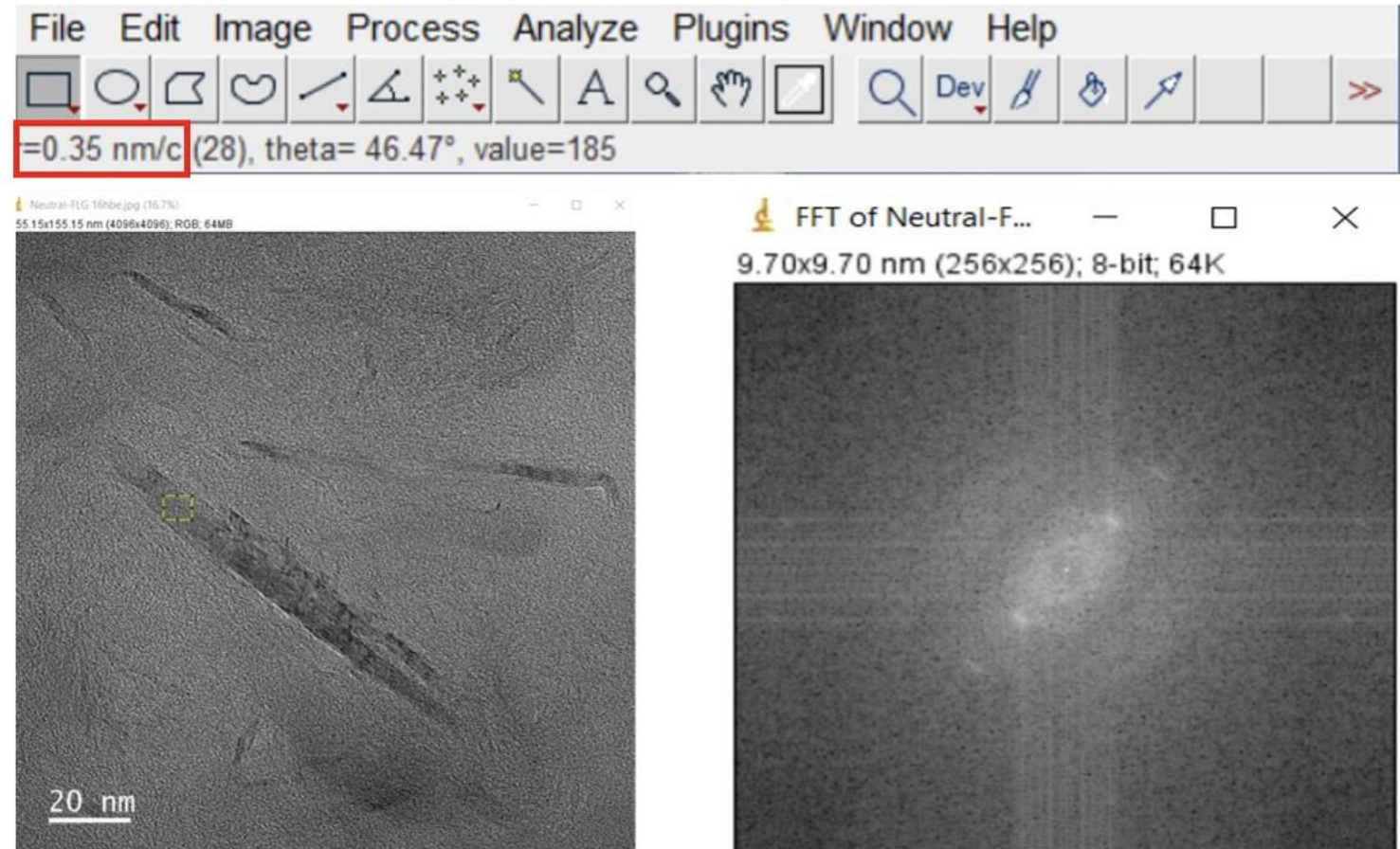


Fig. 5 ENM uptake in monocultured TT1 cells exposed to **a** amine-FLG or **b** amine-FLG-**a** were observed within membrane-bound vesicles outside of the nucleus. **c** the graphene materials) did not appear to influence uptake. Quantitative

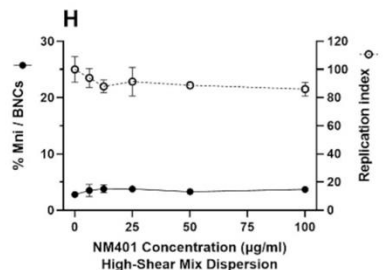
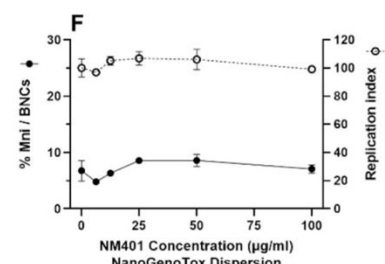
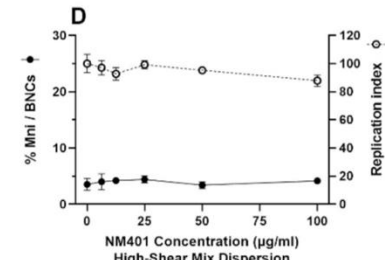
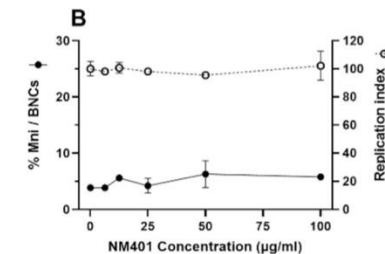
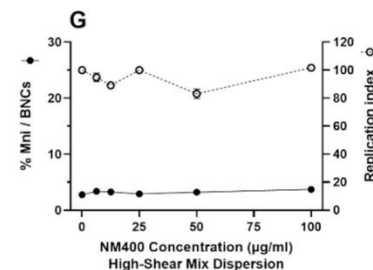
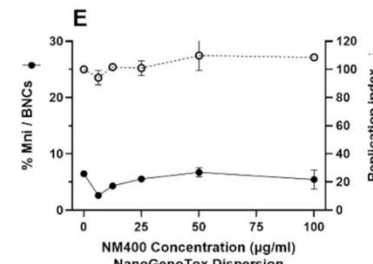
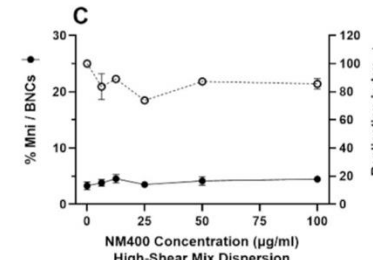
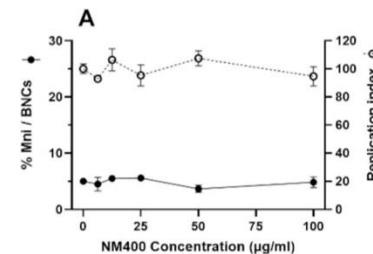
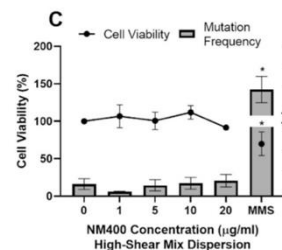
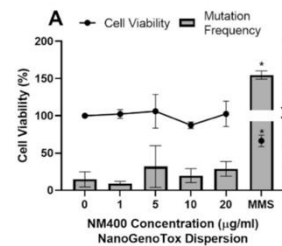
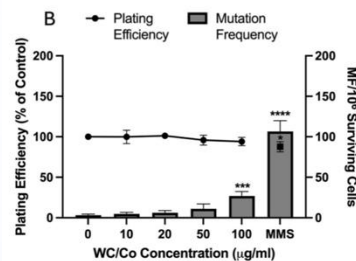
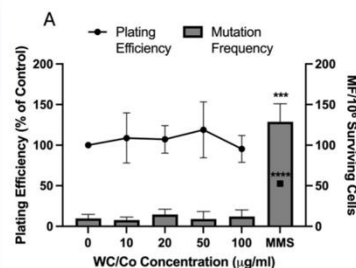
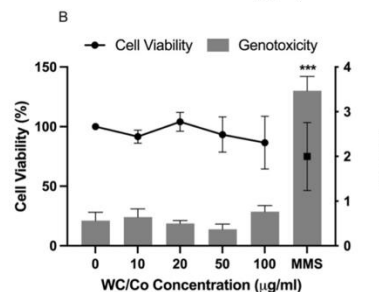
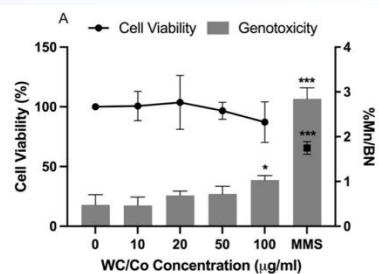
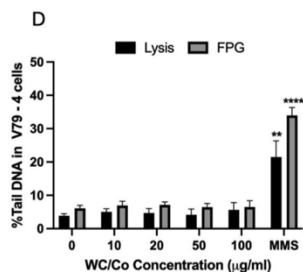
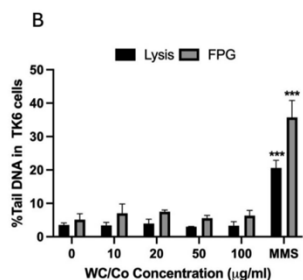




JOURNAL ARTICLE

Tungsten carbide-cobalt can function as a particle positive control for genotoxicity *in vitro* in specific cell lines

Michael J Burgum, Stephen J Evans, Ilaria Zanoni, Magda Blois, Gareth J Jenkins, Shareen H Doak



OECD GD No. 359



JOURNAL ARTICLE

Adapting the *in vitro* micronucleus assay (OECD Test Guideline No. 487) for testing of manufactured nanomaterials: recommendations for best practices

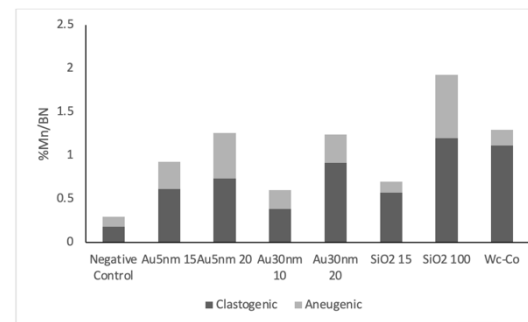


Michael J Burgum, Clarissa Ulrich, Natascha Partosa, Stephen J Evans, Caroline Gomes, Svenja Berit Seiffert, Robert Landsiedel, Naveed Honarvar ✉, Shareen H Doak ✉

- Demonstrate cell line-specific genotoxicity
- Set fourth recommendations for best practices
 - Cell line suitability; p53, stable background micronucleus
 - Cyto B incubation time
 - Dispersion methods
 - Exposure times
 - Compulsory to check uptake

The ratio of the indicated elements to phosphorus in buffy coat, whole blood, and V79 cells after treatment with the indicated concentrations of the given ENMs.

Conc./ml	Buffy coat cells				Whole blood cultures				V79	
	Au _{5nm}	Au _{30nm}	CeO ₂	WC/Co	Au _{5nm}	Au _{30nm}	BaSO ₄	WC/Co	Au _{5nm}	Au _{3i}
	Au/P	Au/P	Ce/P	Co/P	Au/P	Au/P	Ba/P	Co/P	Au/P	Au/
0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	0.02	<LOD	<LOD	<LC
10	0.01	0.003	0.04	---	0.008	0.01	---	---	0.23	0.46
25	---	---	---	---	---	---	---	---	---	---
30	---	---	---	0.08	---	---	1.24	0.019	---	---
50	0.02	0.10	0.04	---	0.035	0.03	---	---	0.48	2.01
60	---	---	---	0.1	---	---	1.61	0.045	---	---
100	0.04	0.058	3.81	0.16	0.089	0.16	1.97	0.072	0.76	4.56



BASF
We create chemistry



JRC TECHNICAL REPORT

In vitro cytotoxicity and cellular uptake evaluation of gold, silica and silver nanoparticles in five different cell lines: Caco-2, A549, CHO, V79 and TK6

Advice

- Research funding
- Publish
- Research Visits
 - BASF
 - The Health Effects Laboratory at NILU
 - National Institute of Biology, Slovenia
- International conferences
- Build a network
- Lecturing



UKEMS Small Grants Scheme for Feasibility or Pilot Studies



Handbook of Nanomaterials for Cancer
Theranostics
2018, Pages 279-303



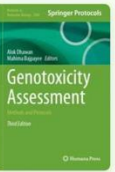
Chapter 10 - Considerations for the Human Health Implications of Nanotheranostics

Michael J. Burgum ^a, Stephen J. Evans ^a, Gareth J. Jenkins, Shareen H. Doak, Martin J.D. Clift

[Home](#) > [Genotoxicity Assessment](#) > [Protocol](#)

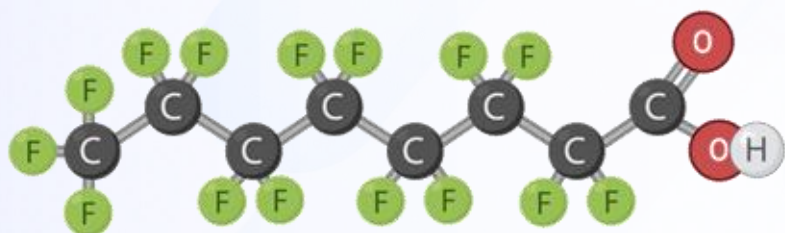
3D Liver Models for Genotoxicity Testing

Protocol | First Online: 23 November 2025
pp 199–216 | [Cite this protocol](#)



Applying new-approach methodologies to the genotoxicity testing of 'forever' chemicals

PFAS



Perfluorooctanoic acid (PFOA)

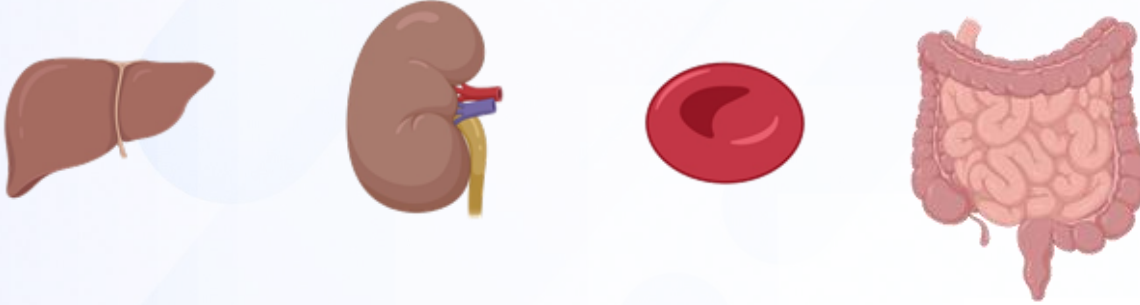


Perfluorooctanesulfonic acid (PFOS)

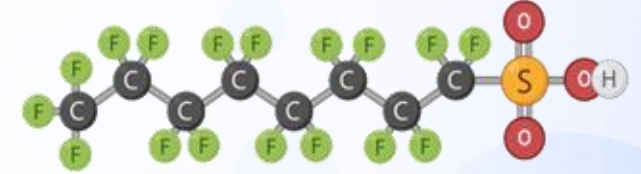


Illustration of example applications of PFAS (source US Dpt. Of defence).

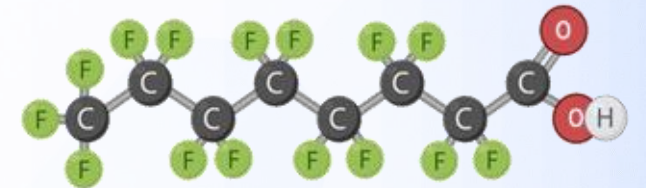
'Forever Chemicals'



- Half Life
 - Short chain (PFBS; C4) ~44 days
 - Long chain (PFOA; C8) ~2.7 years
 - PTFE / TEFLON



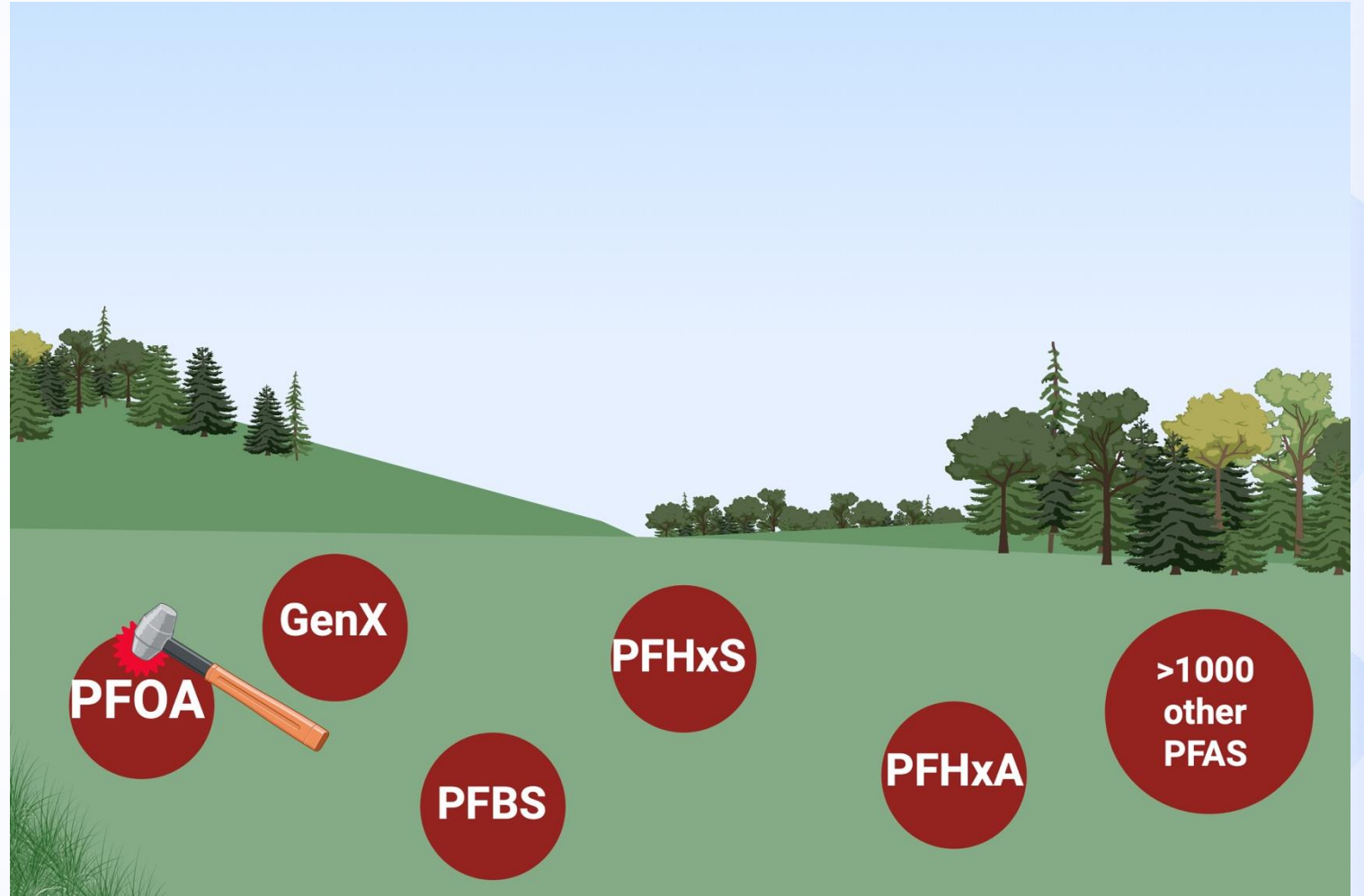
Perfluorooctanesulfonic acid (PFOS)



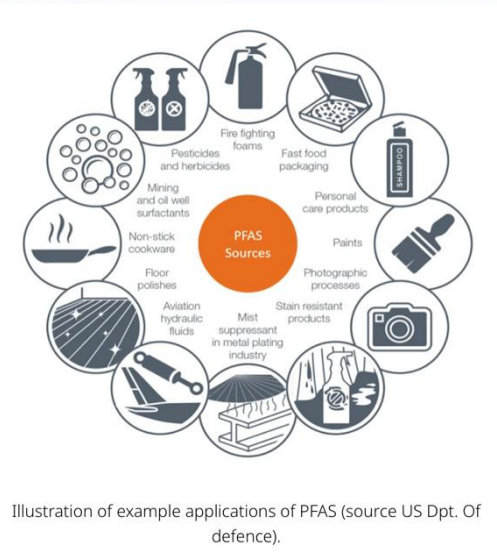
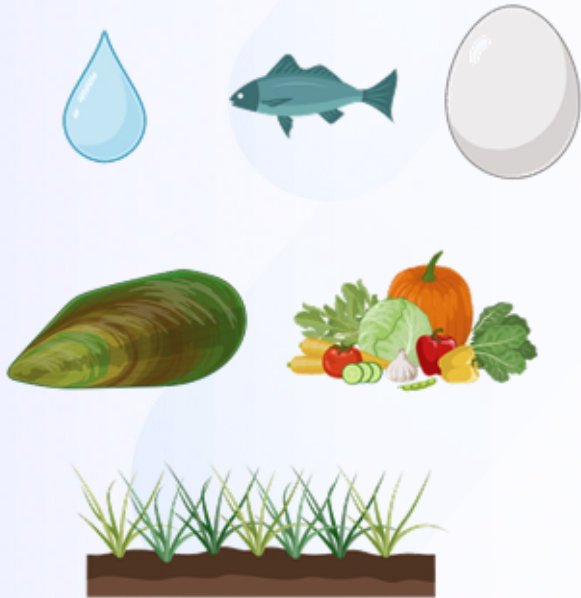
Perfluorooctanoic acid (PFOA)

PFAS Whack-A-Mole

- PFOA & PFOS; 4 PPT
- GenX; 10 PPT



PFAS Exposure



- Typical of the general population
- Potential for adverse health effects
- Increased risk for adverse health effects



<2 ng/ml

2-19 ng/ml

>20 ng/ml



PFAS FREE WATERPROOFING

We eliminated harsh fluorocarbon chemicals from our waterproofs in 2017, maintaining the highest water repellent standards without compromising the environment.

Sainsbury's	Yes ⓘ	Taking action to remove PFAS; yet to confirm commitment in policy
Waitrose	Unknown ⓘ	Taking action to remove PFAS in own brand packaging; yet to confirm commitment in policy

*The information presented here is based on that provided by companies own communication or other referenced

PFAS Alternatives

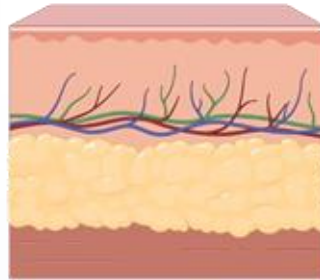
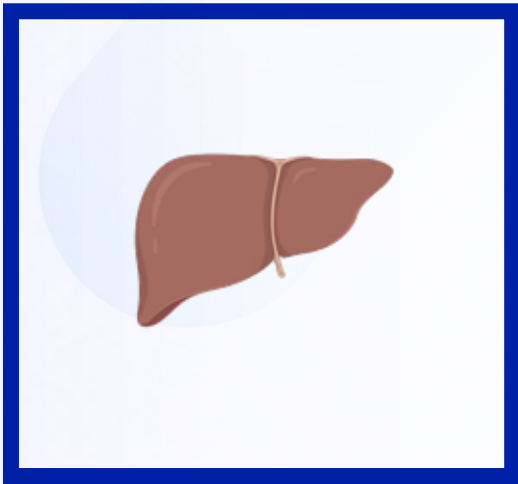
Application	Function of PFAS	Alternative
Non-stick cookware	Low friction coating, thermally stable	Ceramic, cast iron
Clothing	UV-stable, water- and oilproof	Polyurethane
Food packaging	Grease resistant	Cellulose coatings, biopolymers
Fire-fighting foams	Fire suppressant (surfactant layer on fuel source)	Hydrocarbon-based surfactants
Industrial lubricant	Thermal and chemical stability, low friction	Synthetic hydrocarbons
Cosmetics	Water resistant, smooth feel	Plant oils

Consensus on PFAS

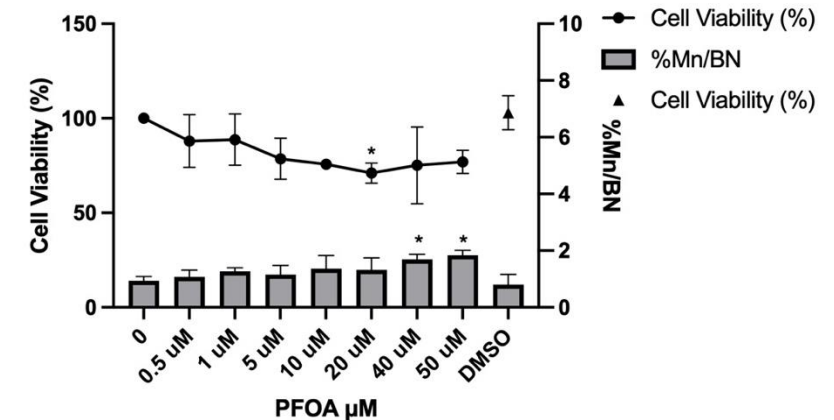
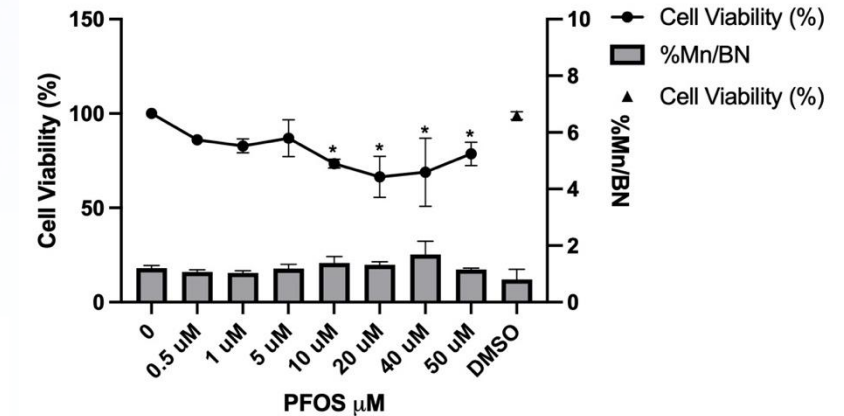
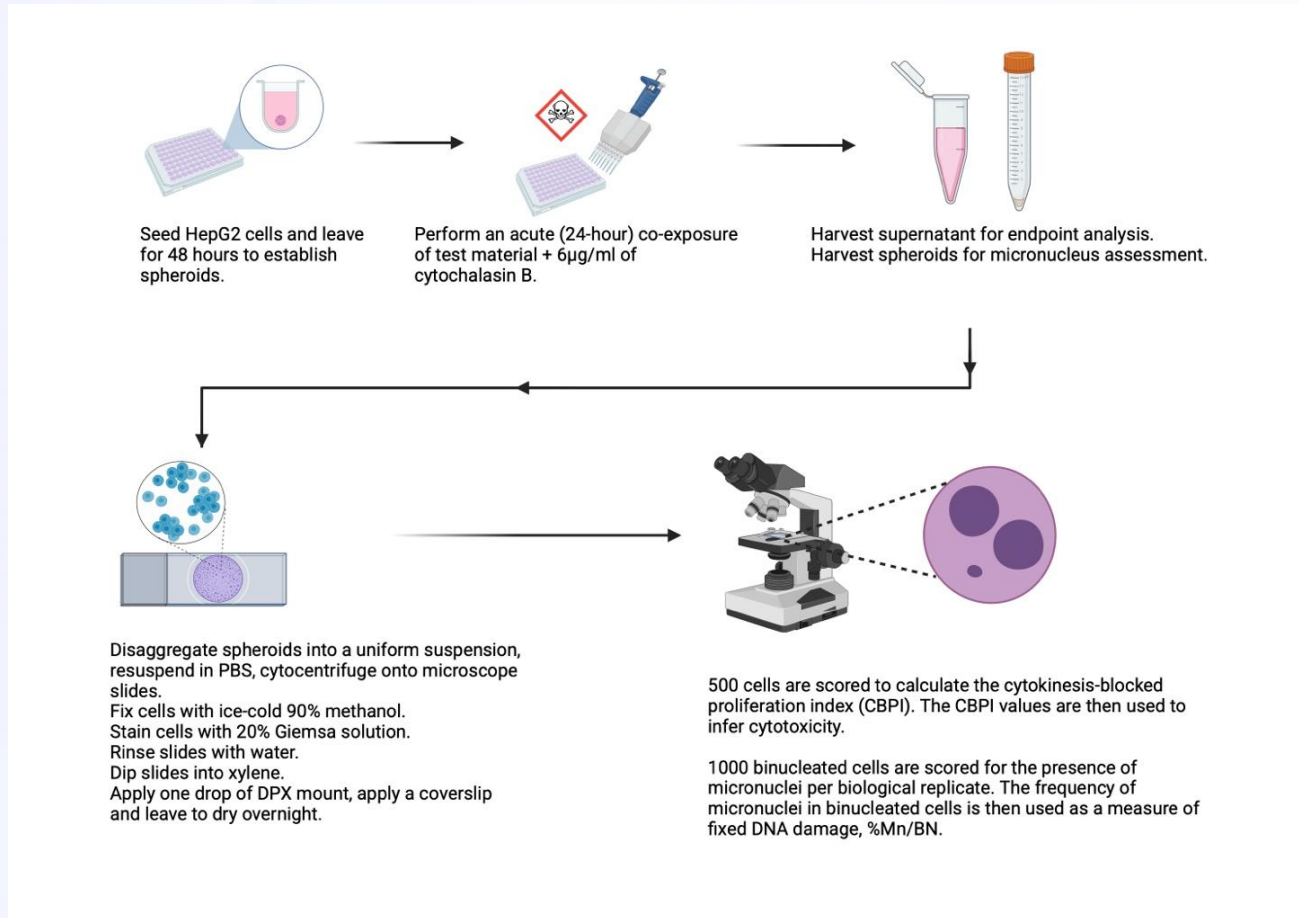
The Working Group evaluated PFOA as *carcinogenic to humans* (Group 1) on the basis of *sufficient* evidence for cancer in experimental animals and *strong* mechanistic evidence that PFOA exhibits key characteristics of carcinogens in exposed humans. There was *limited* evidence in humans for cancer of the testis and for renal cell carcinoma. PFOS was evaluated as *possibly carcinogenic to humans* (Group 2B) on the basis of *strong* mechanistic evidence for key characteristics of carcinogens, including in exposed humans. There was *limited* evidence for cancer in experimental animals and *inadequate* evidence for cancer in humans for PFOS.

New-Approach Methodologies ...Not that new!

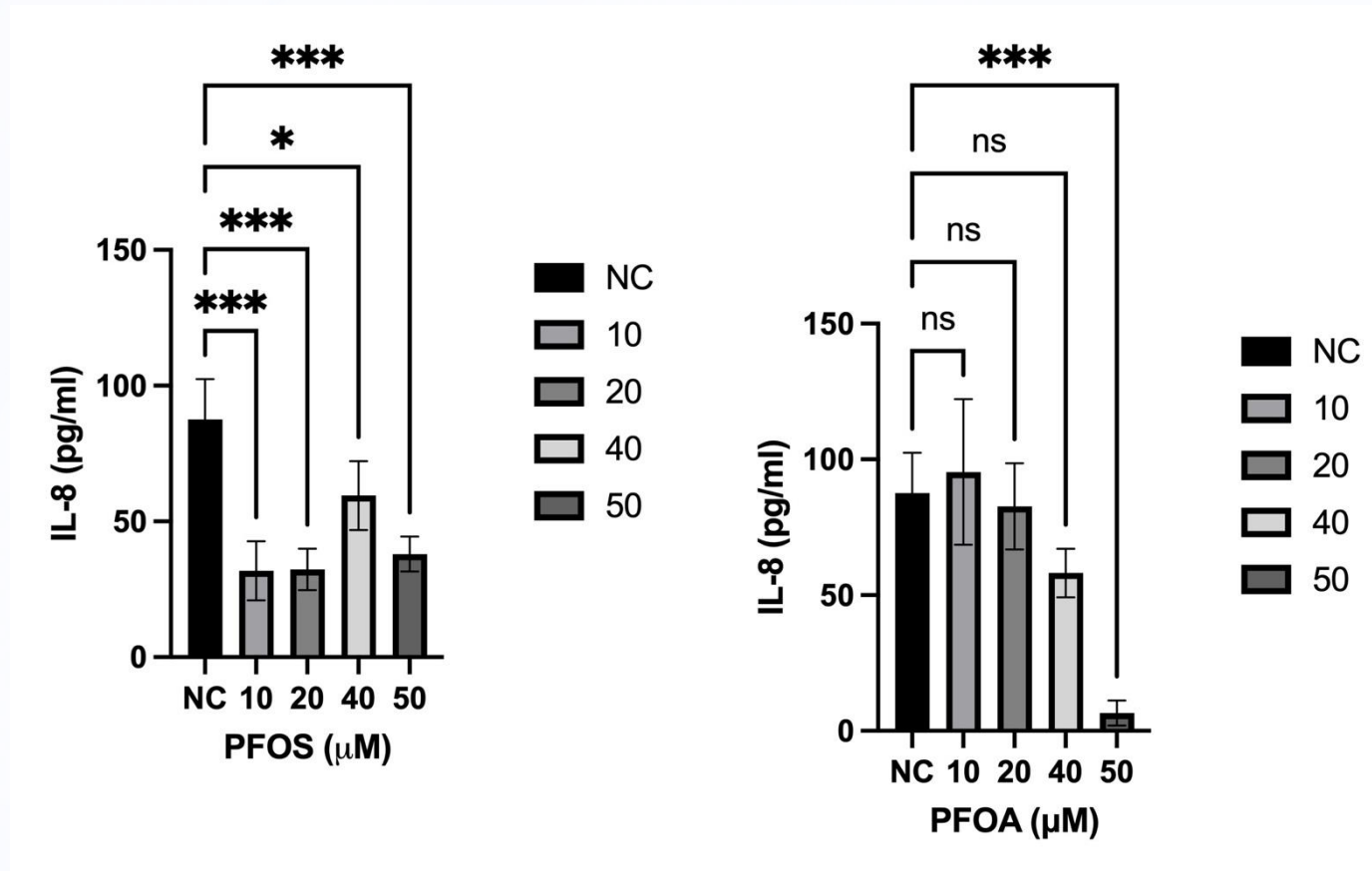
- NAMs must be capable of human and environmental safety evaluation in a regulatory context.



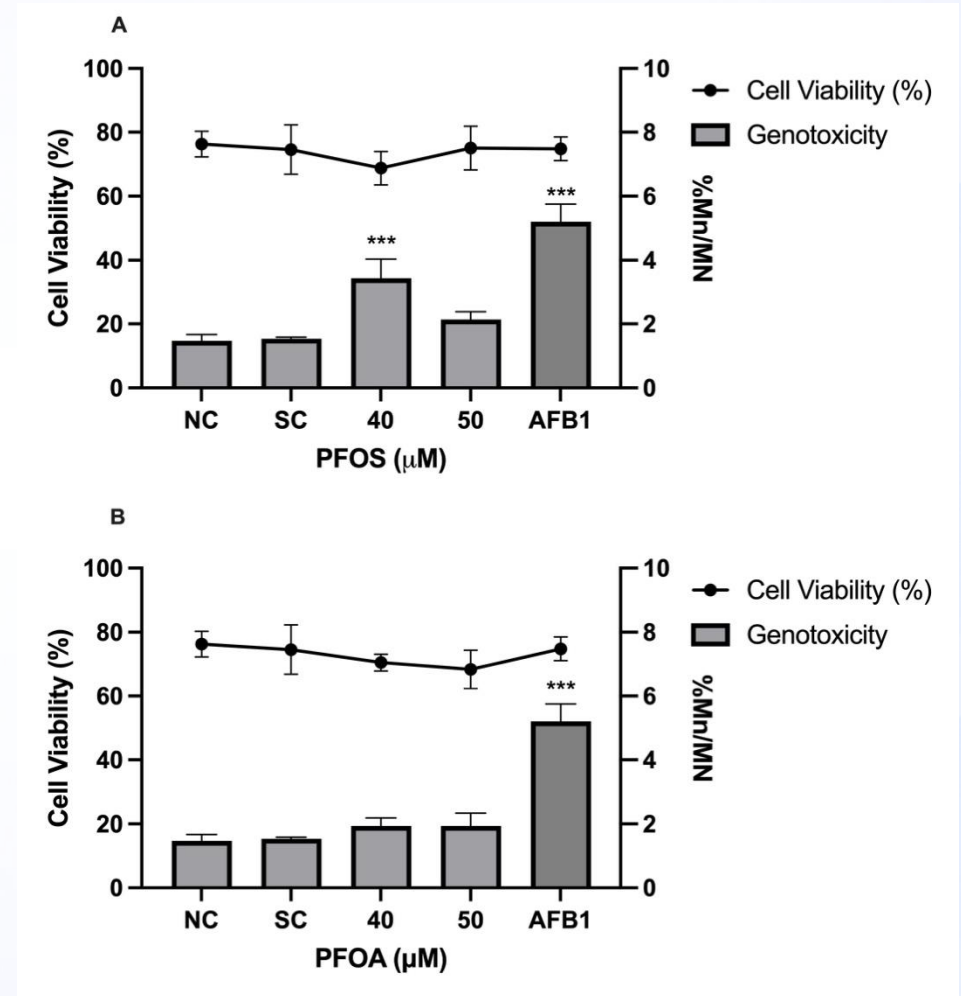
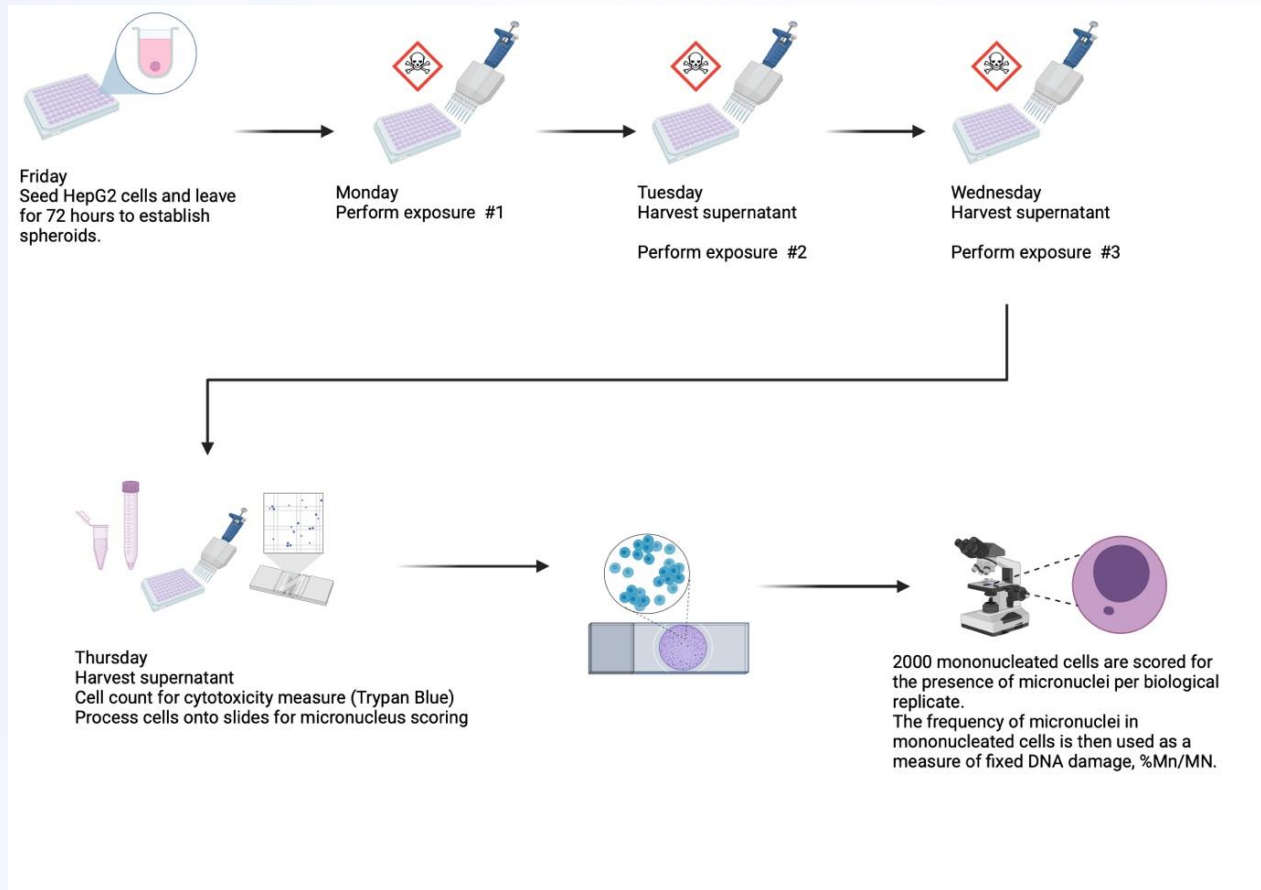
HepG2 Liver Spheroids & Acute Micronucleus



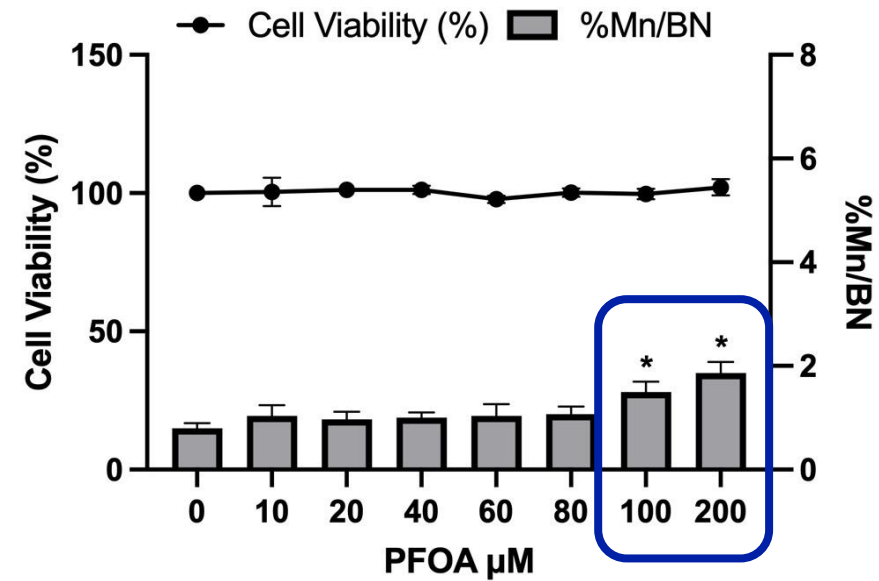
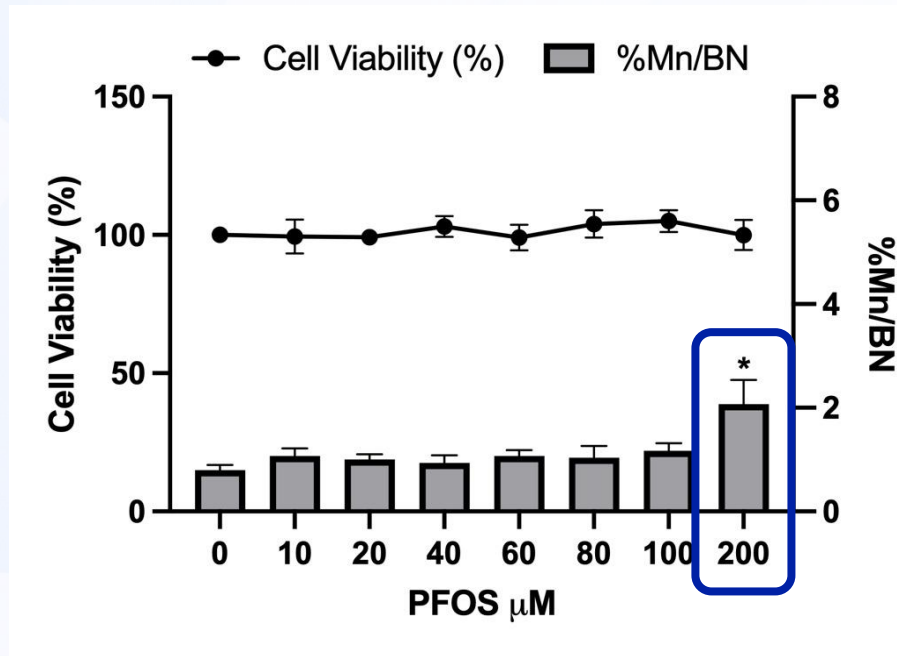
Phase I – PFAS reduces IL-8



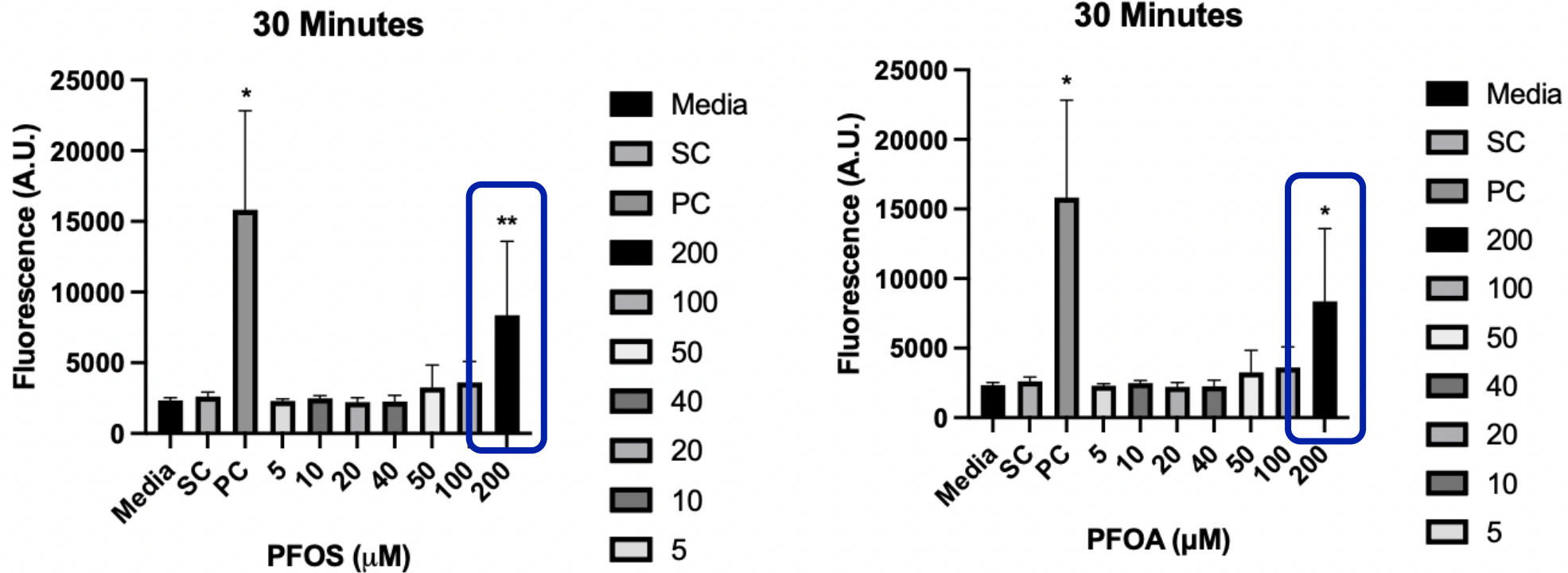
HepG2 Liver Spheroids & Repeat Dose Micronucleus



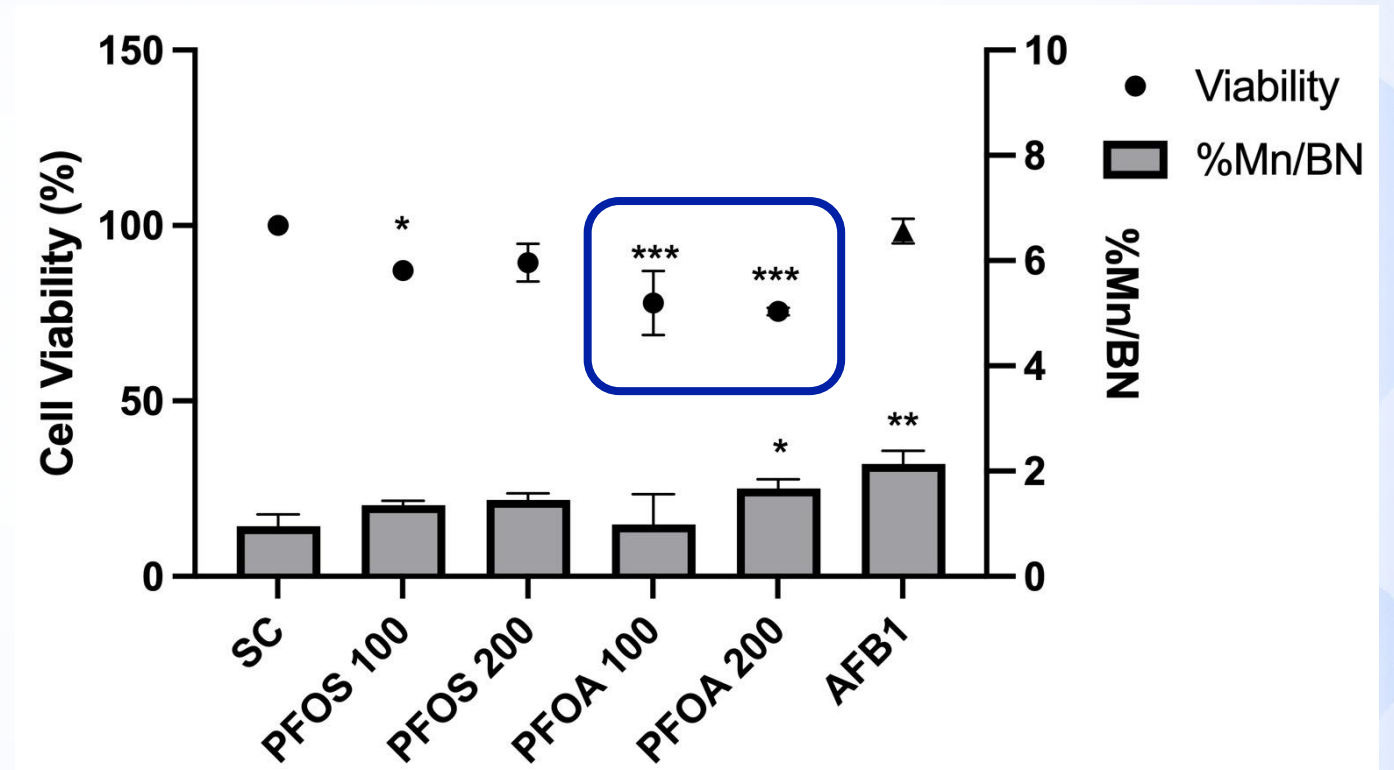
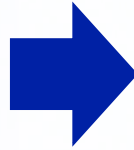
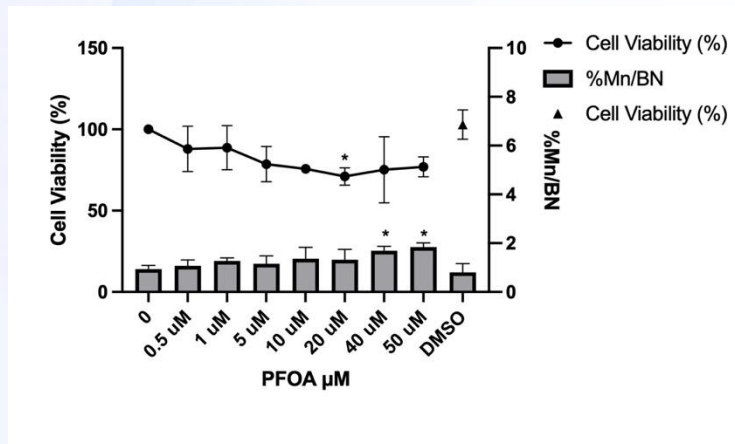
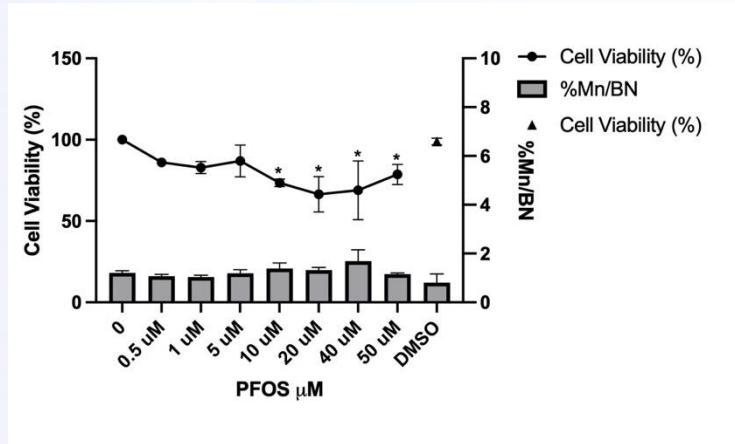
Monocultured HepG2



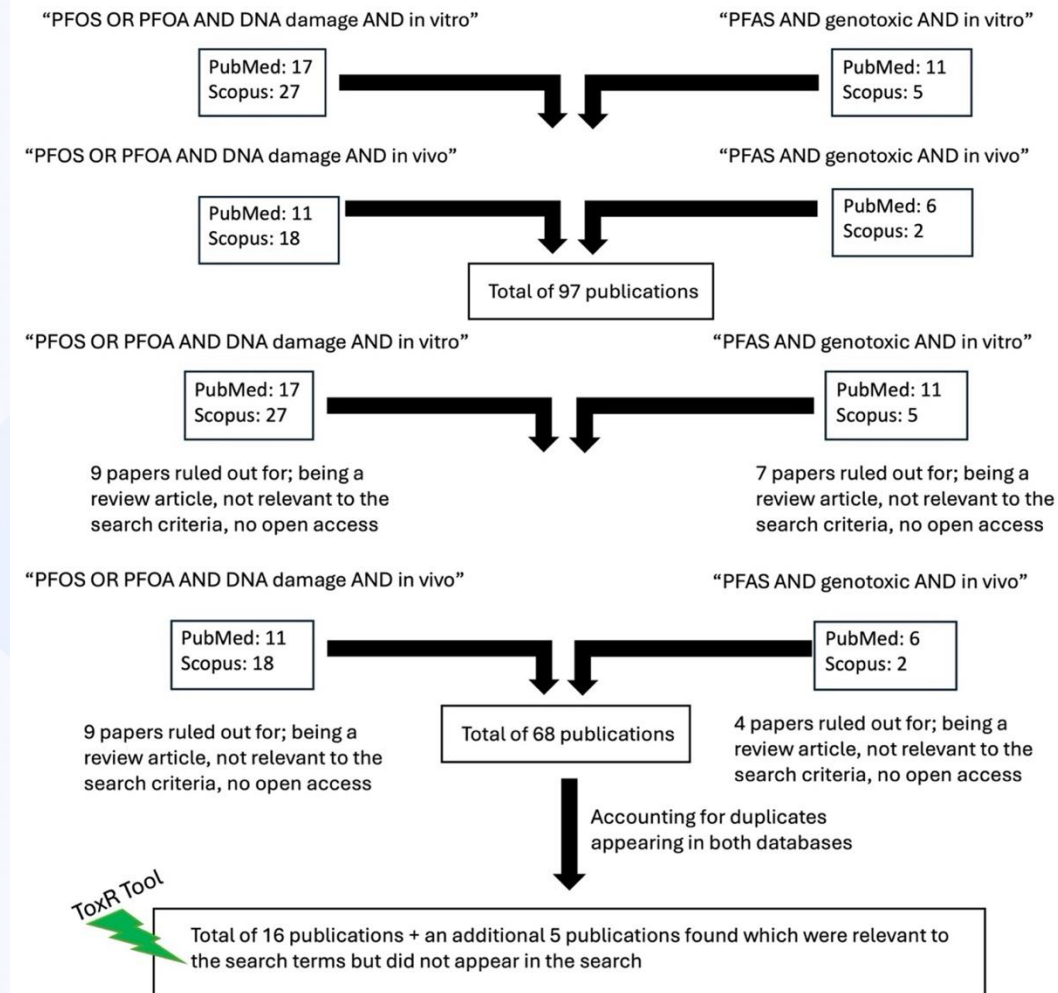
PFAS Induce ROS Production



Back into HepG2 spheroids for 100 & 200 μ M



PFAS Genotoxicity?



- 21 publications (97)
- ToxR, 90%
- 42% of IVM, positive
- 78% of comet, positive
- 50% of gene mutation, positive
- 100% of γ -H2AX & Ames, positive
- Respectable dose ranges
- No use of NAMs

Better models

More robust data?

Greater understanding

Remember

- Celebrate the journey not the results
- Reflect on lessons learned
- Acknowledge that you didn't do this alone

"Awards recognise past achievements; unanswered questions make tomorrow exciting"



THANK YOU

www.CHIASMA-Project.eu

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