CONFERENCE PROGRAM

PLASTICS 2026

Brisbane, Australia

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Contents

Supporting a Respectful and Inclusive Conference Environment

- All participants are expected to engage in a professional, respectful, and collegial manner that supports open and constructive scholarly exchange.
- We are committed to providing a welcoming, safe and inclusive environment for all attendees, regardless of career stage, discipline, background, identity or lived experience.
- Scientific discussion should be thoughtful, evidence-based and constructive. Diverse perspectives are valued, and disagreement should be expressed respectfully and professionally.
- Harassment, discrimination, intimidation, bullying or disruptive behaviour will not be tolerated in any form, whether during formal sessions or at associated events.
- Attendees must comply with conference policies, institutional requirements and venue regulations at all times.
- Participants are encouraged to report any concerns or potential breaches of this Code to conference organisers (or email plastics2026@uq.edu.au), who will address them promptly and confidentially.
- This Code applies to all conference-related activities, including social events, online platforms and digital communications.
- Participants should obtain permission before photographing, recording or sharing images or content featuring other attendees.
- Respect for speakers and time - Please adhere to session time limits and facilitate equitable participation during discussions and Q&A sessions.
- The organisers reserve the right to take appropriate action in response to breaches of this Code, which may include removal from the conference without refund.

Welcome

About Plastics2026

The pervasive presence of plastics in our environment and their potential implications on human health is a growing concern. Health risks exist at all stages of the plastic lifecycle— from production, use, recycling, and eventual disposal, as well as from legacy plastics in the environment. As plastics degrade, they release additives, nano- and micro-plastics, and oligomers, which can infiltrate air, water, and food sources. Increasing evidence of the consumption and inhalation of nano- and micro-plastics, concerns about exposures to harmful additives used to give plastics particular properties, and the need for improved understanding of potential effects on human health and associated risks are becoming integral parts of public health discourse.

This conference aims to bring together scientists, medical professionals, industry leaders, and policymakers to address the urgent need to understand these risks and devise strategies to mitigate negative health impacts. Join us as we explore these critical issues and work towards a healthier future.

Have a question?

Scan the QR code to access the conference website for detailed information.

If you need any assistance throughout the conference, please find one of our wonderful volunteers - they can be identified by their conference t-shirts, or email us at plastics2026@uq.edu.au.

Committees

Scientific Committee

Kevin Thomas	The University of Queensland/QAEHS
Jochen Mueller	The University of Queensland/QAEHS
Grace Davies	The University of Queensland/QAEHS
Derek Muir	Environment & Climate Change Canada
Holger Koch	Ruhr University Bochum
Hongwen Sun	Nankai University
Heather Stapleton	Duke University
Shoji Nakayama	National Institute for Environmental Studies
Gro Delhi Andersen	Norwegian Institute of Public Health
Dorte Herzke	Norwegian Institute of Public Health
Juliette Legler	Utrecht University
Martin Clift	Swansea University
Douglas Walker	Emory University
Zhanyun Wang	EMPA
Adrian Covaci	University of Antwerp
Guibin Jiang	Chinese Academy of Sciences
Roel Vermeulen	Utrecht University

Organising Committee

Kevin Thomas	The University of Queensland/QAEHS
Jochen Mueller	The University of Queensland/QAEHS
Peter Sly	The University of Queensland
Sarah Dunlop	Minderoo Foundation
Christos Symeonides	Minderoo Foundation
Beth Tippett	Minderoo Foundation
Junli (Lily) Xu	University College Dublin
Stephanie Wright	Imperial College London
Anne-Louise Ponsonby	The Florey Institute of Neuroscience & Mental Health
Michaela Lucas	The University of Western Australia
Alena Vdovchenko	Imperial College London
Taicheng An	Guangdong University of Technology
Claire Shepherd	Neuroscience Research Australia

Local Organising Committee

Kevin Thomas	The University of Queensland/QAEHS
Jochen Mueller	The University of Queensland/QAEHS
Cassie Rauert	The University of Queensland/QAEHS
Fisher Wang	The University of Queensland/QAEHS
Elvis Okoffo	The University of Queensland/QAEHS
Ian Zammit	The University of Queensland/QAEHS
Grace Davies	The University of Queensland/QAEHS
Julia Orr	The University of Queensland/QAEHS
Simran Kaur	The University of Queensland/QAEHS
Stephanie Hall	The University of Queensland/QAEHS
Lauren Gubbin	The University of Queensland/QAEHS

SIDE EVENTS
SATURDAY 28 FEBRUARY 2026

Image: Advanced Engineering Building, The University of Queensland

Location:
The University of Queensland, St Lucia,
Advanced Engineering Building (AEB), Staff House Road.
Map

9:00 AM - 10:30 AM	**From Surveys to Systems: Experiencing Grassroots-Informed Risk Assessment Framework (GIRAF) in Practice** Hosted by Ahmed Tiamiyu, Community Action Against Plastic Waste (CAPws) Current approaches to assessing the health risks of plastics rely heavily on laboratory and biomonitoring data, which are often unavailable in low- and middle-income countries, leaving the lived experiences of frontline communities underrepresented in policy decisions. In 2023, CAPws partnered with communities in Obajana, Nigeria, to document respiratory, skin, and eye conditions linked to plastic waste co-processing, translating community knowledge into grassroots epidemiological evidence. This session introduces GIRAF, a practical framework that bridges community insight and scientific assessment through an interactive role-play involving community members, researchers, and policymakers.	Auditorium 200
9:00 AM - 10:30 AM	**Pyrolysis-GCMS Workshop** Hosted by Dr Karthik Sathrugnan, Frontier Laboratories This workshop provides an overview of Pyrolysis–GC/MS for the identification and quantification of micro- and nanoplastics across environmental matrices. It will highlight new hardware developments that enhance sensitivity for trace and ultra-trace analysis, improving efficiency and performance. Participants will also take part in hands-on exercises covering sample filtration and data analysis using F-Search MP software.	Room 316
1:30 PM - 4:30 PM	**Plastics Degradation and Lifetimes** Hosted by Prof Bronwyn Laycock and Prof Steven Pratt, The University of Queensland This side event will focus on the mechanisms and rates of plastics degradation and bioplastics biodegradation. It will cover hazardous states transitions and the environmental factors that can accelerate or slow these transitions. It will also cover how considerations of these factors tie into plastics waste management and the circular economy, and effective management of plastics and bioplastics within a circular economy.	Room 313A
1:30 PM - 3:00 PM	**Seeing the Unseen: Submicron IR Imaging for Microplastics and Nanoplastics** Hosted by Photothermal Spectroscopy Corp. This interactive workshop will showcase how Optical Photothermal Infrared (O-PTIR) and simultaneous Raman microscopy are advancing micro- and nanoplastics research by enabling submicron, label-free identification beyond the limits of conventional techniques. Participants will learn how automated workflows and multimodal imaging accelerate analysis across environmental and biological samples. The session includes a live demonstration of real-time O-PTIR and Raman analysis, highlighting their enhanced spatial resolution and chemical clarity.	Room 301
1:30 PM - 4:30 PM	**Tiny Particles, Big Questions: Microplastic Exposure and Brain Health** Hosted by Prof. Trent Woodruff (UQ), Dr. Eduardo Albornoz (UQ), Dr. Claire Sheperd (NeuRA), Dr. Tim Couttas (NeuRA) This roundtable will examine emerging evidence that micro- and nanoplastic (MNP) exposure may affect brain health and contribute to neurodegenerative processes, including neuroinflammation, oxidative stress, and protein aggregation linked to conditions such as Parkinson's and Alzheimer's disease. Bringing together experts across neuroscience, toxicology, environmental health, epidemiology, and clinical research, the discussion will explore current evidence, methodological challenges, and key research gaps. The session aims to foster interdisciplinary collaboration to advance understanding of MNP impacts on the central nervous system.	Auditorium 200

DAY 1

SUNDAY
1 MARCH 2026

Image: Mary Mahoney AO Amphitheatre, The University of Queensland

Location:
The University of Queensland, St Lucia,
GHD Auditorium, Advanced Engineering Building (AEB).
Map

12:30 PM - 1:30 PM	Registration & Light refreshments	
1:30 PM - 1:50 PM	Official Opening and Welcome to Country	
1:50 PM - 2:00 PM	Welcome to The University of Queensland	**Professor Deborah Terry AC**, Vice-Chancellor, The University of Queensland
2:00 PM - 2:05 PM	Opening Remarks	**Ms Inger Andersen**, Under-Secretary-General of the United Nations and Executive Director of the United Nations Environment Programme
2:05 PM - 2:10 PM	Opening Remarks	**Dr Andrew Forrest AO**, Co-Founder Minderoo Foundation
2:10 PM - 2:50 PM	**Keynote Address** Plastics and Planetary Health: From Science to Policy	**Dr Andrea Hinwood**, Chief Scientist, United Nations Environment Programme
2:50 PM - 3:30 PM	**Keynote Address** Plastic and human health: evidence and solutions	**Emeritus Professor Sarah Dunlop**, Minderoo Foundation **Philip Landrigan**, Lancet Countdown on health and Plastics
3:30 PM - 4:10 PM	**Keynote Address** Health at the Centre: Why the Global Plastics Treaty Must Address the Full Life Cycle of Plastics	**Dr Sivendra Michael**, Permanent Secretary, Ministry of Environment and Climate Change, Fiji
4:10 PM - 4:15 PM	Welcome Event Close	
4:15 PM - 6:15 PM	Networking event, drinks and canapes, Mary Mahoney AO Amphitheatre	

DAY 2

MONDAY
2 MARCH 2026


Image: W Hotel, Brisbane

Location:
Great Room, W Hotel Brisbane,
81 North Quay, Brisbane.
Map

8:00 AM - 8:25 AM	Registration	
8:25 AM - 8:30 AM	Open/Welcome	**Kevin Thomas**, The University of Queensland, QAEHS
Inventory Session Chairs: Holger Koch, Ruhr University Bochum, Germany and Dorte Herzke, Norwegian Institute of Public Health		
8:30 AM - 9:10 AM	**Keynote Address** Mapping the chemical complexity of plastics: Moving from knowns to unknowns	**Martin Wagner**, Norwegian University of Science and Technology (NTNU)
9:10 AM - 9:25 AM	Quantifying the Hidden Plastic Burden: An Inventory of Plastic Materials and their additives in the Built Environment	**Teresa McGrath**, Habitable
9:25 AM - 9:40 AM	From Overview to Insight: Mapping Use, Exposure and Health Effects of Plastic Food Contact Chemicals	**Birgit Geueke**, Food Packaging Forum Foundation
9:40 AM - 9:55 AM	Hidden Chemistry: What Leaches from Our Clothing Microfibres?	**Amanda Dawson**, Griffith University
9:55 AM - 10:10 AM	Prioritization of Plastic-Associated Chemicals for Human Biomonitoring Using an Integrated Hazard–Exposure Framework	**Rui Wang & Jakub Maculewicz**, University of Melbourne
10:10 AM - 10:40 AM	Morning Tea	
10:40 AM - 10:55 AM	Target and non-target analysis of plastic flakes and pellets from Canadian recycling programs	**Derek Muir**, Environment & Climate Change Canada
10:55 AM - 11:10 AM	PlasticHealthAware: a dashboard for presenting up to date Umbrella Review data on plastic chemicals and health outcomes	**Yannick Mulders**, Minderoo Foundation
Analytics Session Chairs: Junli Xu, University College Dublin and Adrian Covaci, Toxicological Center, University of Antwerp		
11:10 AM - 11:50 AM	**Keynote Address** Analytical challenges with human biomonitoring of micro/nanoplastics: Bombshell or progression of science?	**Cassandra Rauert**, The University of Queensland, QAEHS
11:50 AM - 12:05 PM	Operationalizing the plastic exposome with high-resolution mass spectrometry analytical workflows	**Christian Dior Freeman**, Emory University
12:05 PM - 12:20 PM	Tracing the Sources of Laboratory-Origin Microplastic Contamination Using Polymer Fingerprinting	**Karuna Singh**, National Institute of Technology Delhi
12:20 PM - 1:20 PM	Lunch	
1:20 PM - 1:35 PM	Tools for Analysis of Environmental Fate of Nanoplastics in Various Types of Samples	**Maria Hayder**, University of Amsterdam
1:35 PM - 1:50 PM	Toward In-Situ Microplastic Detection Using Broadband Excitation Spectroscopy and Machine Learning	**Nico Merck**, University of Rostock, Institute of General Electrical Engineering
1:50 PM - 2:05 PM	FTIR spectroscopy methods to elucidate the interactions between microplastics and cells	**Helena Friedrich**, King's College London, Diamond Light Source

2:05 PM - 2:20 PM	Development and validation of a Raman microspectroscopy workflow for the detection of micro- and nanoplastics in human blood	**Alena Vdovchenko**, Imperial College London
2:20 PM - 2:35 PM	Analytical advances in mass spectrometry–based detection and quantification of micro- and nanoplastics in human matrices	**Federica Nardella**, Vrije Universiteit Amsterdam
2:35 PM - 3:05 PM	Afternoon Tea	
3:05 PM - 3:20 PM	Exploring the potential of one-pot microwave-assisted pretreatments coupled with PY-GC-MS for the quantification of MPs and associated contaminants	**Alessio Gomiero**, Norwegian Research
3:20 PM - 3:35 PM	Analytical method development, optimisation, and evaluation for the detection and quantification of plastic oligomers in human blood	**Alexandra Richardson**, Imperial College London
3:35 PM - 4:15 PM	**Keynote Address** Environmental distributions and health risks of emerging plastic additives	**Da Chen**, Jinan University
4:15 PM - 4:57 PM	**Flash Poster Talks (3 minutes each)** Session Chairs: Stephanie Wright, Imperial College London and Juliette Legler, Utrecht University	
	Defining Unequivocal: Increasing Confidence In The Analysis And Reporting Of Micro- And Nanoplastic Particles In Biological Matrices.	**Grace Davies**, The University of Queensland, QAEHS
	An All-Inclusive Pipeline for Quality Control Checks and Sample Grouping in PY-GC-HRMS Micro- and Nanoplastic Quantitation Utilizing Skyline and R-Programming	**Christian Dior Freeman**, Emory University
	Confirming Characteristic Pyrolysis Features of Microplastics in Placental Tissue	**Ronald Smith**, Emory University
	ISO compatible, efficient and reproducible protocols/ equipment for micro-nanoplastic detection through machine-learning - COST Action ICPLASTIC	**Gabriela Kalčíková**, University of Ljubljana, Faculty of Chemistry and Chemical Technology
	Car tire particles and their additives: biomarkers for recent exposure and implications for the human exposome	**Dorte Herzke**, Norwegian Institute of Public Health
	Metabolites of phthalate and non-phthalate plasticizers in Australian pooled urine samples from 2020–2021	**Yarui Liu**, Tianjin Medical University
	Nonylphenol exposure in an Australian population using urinary biomarker analysis	**Danielle E. Que**, The University of Queensland, QAEHS
	Does the Presence of Chlorinated Paraffins in Plastic Fruit Stickers Adhesive Pose a Threat to Human Health?	**Chang He**, Guangdong University of Technology
	Tracing micro- and nanoplastics in food: The role of packaging	**Birgit Geueke**, Food Packaging Forum Foundation
	Characterisation of antibodies against plastic-derived chemicals and immunoreactivity in human brain tissue	**Tim Couttas**, Neuroscience Research Australia
	Harmonised Analysis of Airborne Microplastics: Results from the Plastic Dust Cloud Project	**Julia Jaeger**, Eurofins Environment Testing
	A One Health approach to understand plastic pollution risks	**Aaron Schultz**, Deakin University
	Detection and Quantification of Phthalates and Bisphenol A (BPA) in Oral Squamous Cell Carcinoma Using High-Resolution Time-of-Flight Mass Spectrometry	**Yokataa Geetha Saravanan**, Saveetha Dental College and Hospitals
	Assessment of a 7 day low plastic dietary intervention on parameters of good health.	**Andrew Lucas**, The University of Western Australia
5:00 PM - 7:00 PM	Poster Session (includes drinks and canapes)	

DAY 3

TUESDAY 3 MARCH 2026

Location:
Great Room, W Hotel Brisbane,
81 North Quay, Brisbane.
Map

8:35 AM - 8:40 AM	Welcome	Jochen Mueller, The University of Queensland, QAEHS
Exposure Session Chairs: Christian Dior Freeman, Emory University and Cassandra Rauert, The University of Queensland, QAEHS		
8:40 AM - 8:55 AM	Addressing low-concentration BPA quantification challenges in urine samples using a native analyte addition method	**Xianyu (Fisher) Wang**, The University of Queensland, QAEHS
8:55 AM - 9:10 AM	Identification and prioritisation of chemical additives in plastic products using TGA coupled to GC/QTOF-MS	**Sijing Li**, CSIRO
9:10 AM - 9:25 AM	Ongoing exposure to endocrine disrupting plasticizers in neonatal intensive care unit patients	**Adrian Covaci**, University of Antwerp, Toxicological Center
9:25 AM - 9:40 AM	Assessment of infant oral exposure to micro and nanoplastics from plastic feeding and storage containers	**Laura Puente-De La Cruz**, The University of Queensland, QAEHS
9:40 AM - 9:55 AM	Multimodal detection and analysis of microplastics in human thrombi from multiple anatomically distinct sites	**Shaowei Guo**, The First Affiliated Hospital of Shantou, University Medical College
9:55 AM - 10:25 AM	Morning Tea	
10:25 AM - 10:40 AM	Plastics related chemicals in continuously archived 24-hour urine samples of the German Environmental Specimen Bank from 1995 to today: time trends, exposure and risk assessment	**Holger Martin Koch**, Ruhr University Bochum
10:40 AM - 10:55 AM	Human exposure to Tire-Related Chemicals in Europe	**Mercè Garí**, Institute of Environmental Assessment and Water Research
10:55 AM - 11:10 AM	Micro and nanoplastics exposure in young athletes playing football on a field with tyre rubber granulates as infill	**Hubert Dirven**, Norwegian Institute of Public Health
11:10 AM - 11:25 AM	Determinants of exposure to micro- and nanoplastics in women of reproductive age	**Amanda Durkin**, University Medical Center Utrecht
11:25 AM - 11:40 AM	Human exposure to plastic additives through dermal contact with menstrual products	**Lara Cioni**, Institute of Environmental Assessment and Water Research
11:40 AM - 11:55 AM	Migration of plastic and adhesive-related oligomers (PAROs) from puree pouches: a comparison between food simulants and food samples	**Cheng (Ken) Tang**, The University of Queensland, QAEHS
11:55 AM - 12:10 PM	Per- and Polyfluoroalkyl Substances in the Human Brain	**Marina Suzuki**, The University of Queensland, QAEHS
12:10 PM - 1:10 PM	Lunch	
1:10 PM - 1:25 PM	Evaluating microplastic particles as vectors of exposure for plastic additive chemicals using a food web model	**Todd Gouin**, TG Environmental Research
1:25 PM - 1:40 PM	Atmospheric Microplastics in Urban and Remote Areas: Occurrence, Sources and Seasonality	**Natascha Schmidt**, NILU
1:40 PM - 1:55 PM	Understanding spatial and temporal trends of atmospheric microplastics and nanoplastics in laboratories	**Honglin Chen**, The University of Queensland, QAEHS

1:55 PM - 2:10 PM	Advancing Indigenous-led Microplastic and Nanoplastic Research in Indigenous Communities	**Lynn Jacobs**, McGill University
Toxicology Session Chairs: Claire Shepherd, Neuroscience Research Australia and Christos Symeonides, Minderoo Foundation		
2:10 PM - 2:50 PM	**Keynote Address** There's a little Barbie in all of us (nanoplastics), but is there cause for concern	**Phoebe Stapleton**, Rutgers University
2:50 PM - 3:05 PM	Fabrication of Micro/Nanoplastic Particles and Fibres for In Vitro Alveolar Exposure Studies	**Eric Auyang**, Imperial College London
3:05 PM - 3:35 PM	Afternoon Tea	
3:35 PM - 3:50 PM	The impacts of microplastics and indoor microplastic-aerosol mixtures on THP1 macrophage immunometabolism	**Stephanie Wright**, Imperial College London
3:50 PM - 4:05 PM	Mechanistic studies of inhaled microplastics in the human lung in vitro	**Julia Laskowska**, Imperial College London
4:05 PM - 4:20 PM	Nanoplastics activate innate immunity in microglia and exacerbate α-synuclein–induced neurotoxicity	**Eduardo Albornoz**, The University of Queensland, School of Biomedical Sciences
4:20 PM - 4:35 PM	Exploring the interaction of carboxylated polystyrene nanoplastics with hepatic cell lines and human precision-cut liver slices	**Namrata Pandey**, University of Plymouth
4:35 PM - 4:50 PM	Cytotoxicity of Polystyrene Nanoplastics: Role of Ageing-Driven Oxidation and Protein Corona Formation	**Emine Merve Canga**, University College Dublin
4:50 PM - 6:30 PM	Break	
6:30 PM - 7:00 PM	Pre-dinner drinks Great Room Foyer, W Hotel	
7:00 PM - 9:00 PM	Conference Dinner Great Room, W Hotel	

DAY 4

WEDNESDAY 4 MARCH 2026

Location:
Great Room, W Hotel Brisbane,
81 North Quay, Brisbane.
Map

8.25 AM - 8:30 AM	Welcome	Kevin Thomas, The University of Queensland/QAEHS
Toxicology Session Chairs: Claire Shepherd, Neuroscience Research Australia and Christos Symeonides, Minderoo Foundation		
8:30 AM - 8:45 AM	Keeping the MOMENTUM going: highlights of 5 years of microplastics and health research in the Netherlands	**Juliette Legler**, Utrecht University
8:45 AM - 9:00 AM	Systemic inflammation and cardiometabolic dysfunction induced by nylon and polyester micro- and nanoplastic exposure	**Patrick Lelliott**, Baker Heart and Diabetes Institute
9:00 AM - 9:15 AM	Assessing the permeation of surface-modified nanoplastics (NPs) across in vitro human gut-blood and blood-brain barrier models	**Yufei (Lily) Pan**, The University of Queensland, QAEHS
9:15 AM - 9:30 AM	Investigating isolated and combined co-exposure of micro(nano)plastics and air pollution particulate matter using in vitro models of the alveolar barrier	**Kirsty Meldrum**, Swansea University
9:30 AM - 9:45 AM	Novel Near-Infrared Imaging for Toxicological Studies of Microplastics and Nanoplastics	**Lanpeng Yang**, Nankai University
9:45 AM - 10:15 AM	Morning Tea	
Risk & Epidemiology Session Chairs: Roel Vermeulen, Utrecht University and Michaela Lucas, University of Western Australia		
10:15 AM - 10:55 AM	**Keynote Address:** A Decade of Epidemiological Insight from JECS: Plastics-Associated Chemicals, Human Exposure and Health Risks in a National Birth Cohort	**Shoji Nakayama**, National Institute for Environmental Studies
10:55 AM - 11:10 AM	Pathway-Based Genetic Score for Xenobiotic Metabolism: An Indicator of Host Vulnerability to Plastics-Induced Neurological Conditions	**Ahmed Elagali**, Minderoo Foundation
11:10 AM - 11:25 AM	Kynurenine metabolism in pregnancy: a central pathway linking prenatal chemical exposures to autism	**Katherine Drummond**, The Florey Institute of Neuroscience and Mental Health
11:25 AM - 11:40 AM	Associations Between Maternal Phthalate Mixtures and the Gut Microbiome during Late Gestation	**Thomas Boissiere-O'Neill**, The University of Queensland
11:40 AM - 11:55 AM	Prenatal Plastic-Associated Chemical Exposure and Child Neurodevelopment: Insights from the Norwegian Mother, Father and Child Cohort Study (MoBa)	**Gro Dehli Andersen**, Norwegian Institute of Public Health
11:55 AM - 12:10 PM	Plastic related chemicals and neuropsychomotor development and mental health during childhood	**Kinga Polanska**, Department of Environmental and Occupational Health Hazards, Nofer Institute of Occupational Medicine

12:10 PM - 12:55 PM	Lunch	
12:55 PM - 1:15 PM	**Invited Speaker:** Environmental health research: composite chemical exposures and building causal inference by understanding molecular pathways and genetic susceptibility	**Anne-Louise Ponsonby**, The Florey Institute of Neuroscience and Mental Health
1:15 PM - 1:30 PM	The influence of prenatal exposure to 'plastic chemicals' on maternal and child health, brain structure, neurodevelopmental outcomes, and the infant epigenome: Findings from APrON Neurotox	**Deborah Dewey**, University of Calgary
1:30 PM - 1:45 PM	Socioeconomic latent classes modify the relationship between maternal PFAS exposure profiles and perinatal outcomes in the Norwegian Mother, Father and Child Cohort Study (MoBa)	**Adriano Winterton**, Norwegian Institute of Public Health
1:45 PM - 2:00 PM	Health at the Heart of Plastic Governance: A Grassroots-Informed Risk Framework for Vulnerable Populations	**Ahmed Tiamiyu**, Community Action Against Plastic Waste (CAPws)
2:00 PM - 2:30 PM	Documentary Screening: **Voices of the Pacific**	
2:30 PM - 3:00 PM	Voices of the Pacific: Q&A Panel with the film makers	Chair: Xianyu (Fisher) Wang, The University of Queensland, QAEHS **April Howard**, Rollingball Productions **Thava Palanisami**, The University of Newcastle **Nina Wootton**, The University of Adelaide **Sivendra Michael**, Fijian Government, Environment and Climate Change
3:00 PM - 3:30 PM	Afternoon Tea	
Regulation & Policy Session Chairs: Sarah Dunlop, Minderoo Foundation and Anne-Louise Ponsonby, The Florey Institute of Neuroscience and Mental Health		
3:30 PM - 4:10 PM	**Keynote Address:** Plastic Food Contact Materials: establishing safety, ensuring sustainability	**Jane Muncke**, Food Packaging Forum Foundation
4:10 PM - 4:25 PM	Grouping of chemicals into human-readable groups: a case study on food contact chemicals	**Helene Wiesinger**, Food Packaging Forum Foundation
4:25 PM - 4:40 PM	Advancing Chemicals Risk Management Through Cheminformatics and Data Integration	**Daniel Weber**, Australian Government Department of Climate Change, Energy, the Environment and Water
4:40 PM - 4:55 PM	Utilising evidence on PFAS to inform regulation, policy and behavioural change	**Louise Goodes**, Minderoo Foundation
4:55 PM - 5:10 PM	Minnesota affordable housing policies lead the way in encouraging avoidance of worst in class plastic building materials and selection of healthier alternatives	**Teresa McGrath**, Habitable
5:10 PM - 5:25 PM	From National Policy to Local Crisis: Institutional Fragmentation, Open Burning, and Health Risks from Plastic Pollution in Kandy, Sri Lanka	**Dinushika Yapa Abeywardhana**, University of Peradeniya
5:25 PM - 5:40 PM	Plastics Governance in Nigeria and Sub-Saharan Africa: Pathways to a Circular Future	**Temilola Oluseyi**, University of Lagos
5:40 PM - 5:55 PM	Awards and Close	Jochen Mueller and Kevin Thomas

SIDE EVENT

THURSDAY
5 MARCH 2026

Location:
The University of Queensland
Queensland Alliance for Environmental Health Sciences,
Susan Tett Building, Level 3, 20 Cornwall Street, Woolloongabba.
Map

9:00 AM - 11:00 AM	**Career Panel: Real Paths, Real Talk** Featuring professionals from research, industry, government, and consultancy, this career panel session focuses on real stories, unexpected turns, and honest lessons learned along the way. Panellists will share practical advice on building skills, navigating uncertainty, and finding opportunities beyond traditional career paths, ideal for students and early-career professionals looking for relatable insights and realistic guidance.	Room 3088

OPENING REMARKS

PROFESSOR DEBORAH TERRY AC
Vice-Chancellor, The University of Queensland

Professor Deborah Terry AC is a highly experienced leader in the Australian university sector – and an internationally recognised scholar in psychology.

Since August 2020, Professor Terry has served as Vice-Chancellor and President of The University of Queensland (UQ). Prior to this, she was Vice-Chancellor of Curtin University in Western Australia, from 2014 to 2020.

Having grown up in Perth and Canberra, Professor Terry completed her PhD in Social Psychology at the Australian National University in Canberra. She moved to Brisbane in 1990 to begin her academic career in UQ's School of Psychology. Between 1990 and 2014, Professor Terry progressed through a range of academic positions at UQ before moving into senior university leadership roles, up to Senior Deputy Vice-Chancellor.

Professor Terry is the current Chair of the Group of Eight (Go8), comprising Australia's 8 leading research-intensive universities – and she previously served as Chair of Universities Australia.

Professor Terry is also a Fellow and past President of the Academy of Social Sciences in Australia and an appointed member of the Australian Research Council Advisory Council. She currently serves on the Boards of AARNET and Westpac Scholars, and she is a member of the Universitas 21 Executive Committee.

She was appointed a Companion of the Order of Australia (AC) in January 2024 for "eminent service to tertiary education as an institutional leader and academic, to the strengthening of higher education through collaboration and innovation, and to the community".

MS INGER ANDERSEN
Under-Secretary-General of the United Nations and Executive Director of the United Nations Environment Programme

Inger Andersen is Under-Secretary-General of the United Nations and Executive Director of the United Nations Environment Programme, headquartered in Nairobi, Kenya.

Between 2015 and 2019, Ms. Andersen was the Director-General of the International Union for Conservation of Nature (IUCN).

Ms. Andersen has more than 30 years of experience in international development economics, environmental sustainability, strategy and operations. She has led work on a range of issues including agriculture, environmental management, biodiversity conservation, climate change, infrastructure, energy, transport, and water resources management and hydro-diplomacy.

Between 1999 and 2014, Ms. Andersen held several leadership positions at the World Bank including Vice President of the Middle East and North Africa; Vice President for Sustainable Development and Head of the CGIAR Fund Council.

Prior to her 15 years at the World Bank, Ms. Andersen worked 12 years at the United Nations, first on drought and desertification, beginning with the UN Sudano-Sahelian Office. In 1992, she was appointed UNDP's Water and Environment Coordinator for the Arab Region.

Ms. Andersen holds a Bachelors from the London Metropolitan University North and a Masters in Development Economics from the School of Oriental and African Studies, University of London.

OPENING REMARKS

DR ANDREW FORREST AO
Executive Chairman and Founder of Fortescue, Founder of Minderoo Foundation and Tattarang

Dr Andrew Forrest AO is a global business and philanthropic leader committed to ending fossil fuel use, accelerating green energy, and addressing urgent global challenges, including climate change, humanitarian crises, modern slavery, ocean degradation, plastic pollution, and the safe governance of emerging technologies.

He is the founder and Executive Chairman of Fortescue, Australia's most successful company for shareholder returns and one of the world's leading miners and infrastructure operators. With a market capitalisation of $45 billion, Fortescue is consistently ranked among the country's largest taxpayers.

Fortescue has built the world's lowest-cost, most efficient mining operations through a relentless focus on technology and innovation. It is on track to become the first heavy industry company in the world to eliminate fossil fuels from its operations and achieve Real Zero profitably within this decade.

Dr Forrest also established Minderoo Foundation, Australia's largest philanthropy, underpinned by a $9 billion endowment and a mission to improve lives globally. Its focus areas include climate and ocean health, plastic pollution and human health, the democratisation and safety of artificial intelligence, humanitarian relief in conflict zones including Ukraine and the Middle East, the defence of human rights, and gender equality.

Over two decades, Minderoo has invested in world-leading research, programs, and advocacy initiatives that deliver practical, lasting change – including lifesaving humanitarian assistance to civilians in Gaza and Ukraine.

Through Tattarang, Australia's largest private investment group, Dr Forrest invests in sectors critical to national resilience and prosperity. These include renewable energy, battery metals, high-performance shipbuilding, iconic Australian brands, medical technology, agri-food, and property. The group is guided by the principle: using capital only as a force for good.

Dr Forrest holds a PhD in Marine Ecology and was appointed an Officer of the Order of Australia for his distinguished service to philanthropy, mining, employment, and sustainable foreign investment.

Dr Forrest is a board member of Harvard's Salata Institute Advisory Board (SIAB), a member of the Giving Pledge and in 2025 was named one of TIME's 100 Most Influential People in the world.

keynote speakers

DR ANDREA HINWOOD

Chief Scientist, United Nations Environment Programme

Dr Andrea Hinwood serves as the Chief Scientist of the United Nations Environment Programme. She is an environmental scientist with specialization in environmental and human exposures and implications for human health. Dr. Hinwood earned her PhD in environmental epidemiology from Monash University in Melbourne, Australia. She has worked on a range of local, regional and international environmental issues, and provided strategic advice to governments and a variety of international fora including chemicals, waste and pollution. She served as the first Chief Environmental Scientist at the Environment Protection Authority (EPA) in Victoria, Australia and was previously an Associate Professor at Edith Cowan University and held appointments as a member and Deputy Chair of the Environmental Protection Authority of Western Australia and a sessional member of the State Administrative Tribunal of Western Australia.

ABSTRACT

Plastics and Planetary Health: From Science to Policy

Andrea Hinwood and Dina Abdelhakim

United Nations Environment Programme

Plastics, including monomers, oligomers, polymers and harmful chemical additives, are released into the environment at every stage of their lifecycle, from the production of precursor chemicals and materials to manufacturing, use, and disposal. Today, humanity produces more than 430 million tonnes of plastic annually, a figure expected to double by 2040. Two-thirds of these plastics are short-lived products that rapidly become waste, filling rivers, lakes and oceans, contaminating soil and, often, working their way into the human food chain.

Over 95% of plastics are produced from fossil fuels and comprise complex mixtures of polymers and chemical additives, which dictate functionality, performance and appearance of a given plastic product. An estimated 10,000 to 16,000 chemicals are known to be present in plastics, with fewer than 6% subject to any form of regulation, and many more remaining unknown and unmeasured.

The presence of plastics and associated harmful chemical additives in humans has been shown to increase the risk of adverse health effects across communities. Without comprehensive lifecycle management of plastics, environmental contamination, human exposure and risk of adverse health effects are expected to continue and intensify. Plastic pollution is one of the defining environmental and public health issues of this century, hence rapid global and national level policy responses are essential to address both environmental and human health exposures and risk.

EMERITUS PROFESSOR SARAH DUNLOP

Minderoo Foundation

Sarah Dunlop is Director, Plastics & Human Health Impact Mission at Minderoo Foundation and Emeritus Professor, The University of Western Australia. She leads pioneering research to eliminate the harmful effects of plastic by identifying casual evidence for harm to human health, thereby establishing industry accountability, and by developing safe and sustainable alternative materials. Since joining Minderoo in 2020, she has built and spearheaded global collaborations across Australia, Europe, the UK and US to undertake keystone research to drive systems change. The work involves defining the extent of the problem by synthesising existing evidence, developing accurate measurement techniques for plastic chemicals and micro- and nanoplastic particles in human biospecimens, and using hybrid epidemiology and clinical trials to uncover causal mechanisms underlying health impacts from plastic exposure. Parallel work involves accelerating the development and scaling of non-fossil fuel-based materials which do not contain toxic chemicals or fragment into micro- and nanoplastics.

ABSTRACT

Plastic and human health: evidence and solutions

Sarah Dunlop[1,2] and Philip J. Landrigan[4,5]

[1] *Minderoo Foundation, 171-173 Mounts Bay Road, Perth, Western Australia 6000, Australia*
[2] *School of Biological Science, The University of Western Australia, 35 Stirling Highway, Crawley WA 6009, Australia*
[3] *Boston College,140 Commonwealth Avenue, Chestnut Hill MA 02467, USA*
[4] *Centre Scientifique de Monaco, Monaco, MC*

Plastic is produced in unprecedented and accelerating amounts with grave and growing dangers to human and planetary health. Minderoo Foundation is proud to lead as a first mover in supporting world-leading science and scientists to identify evidence that puts human health at the centre of the plastics problem and to find solutions. Despite multiple material benefits, plastic harms human health across its life cycle of production, use and disposal. Plastic is toxic containing thousands of chemicals which leach from products, enter our bodies and cause harm from before birth including adverse reproductive, endocrine, neurodevelopmental, nutritional, circulatory, respiratory, dermatological and cancer outcomes. Plastic also fragments into micro- and nanoplastics which also enter the human body.

Developing accurate measurement techniques for plastic chemicals and particles in humans is critical to understanding the full impacts of plastic on human health. Causal evidence from clinical trials and hybrid epidemiology is strengthening the evidence, as is calculating the seldom-recognised, but high, health costs. In addition to highlighting the problems, designing safe and sustainable alternative materials is key to the solution. Putting the evidence in the right hands, including policy makers, intergovernmental organisations, NGOs, scientists and health practitioners and the general publics is mission critical to ensure continued mainstream dissemination. The Lancet Countdown on Health and Plastic is tracking impacts of plastic on health over time by developing global indicators across four domains namely production, exposures, health impacts and interventions and engagement. The Lancet Countdown will provide robust evidence to inform evidence-based policy internationally and nationally for the benefit of global public health.

keynote speakers

DR SIVENDRA MICHAEL
Fijian Government, Environment and Climate Change

Dr. Sivendra Michael is Fiji's Permanent Secretary for Environment and Climate Change. He has over a decade of work experience in the climate change and disaster management field across Asia Pacific and Eastern African. Prior to joining the Fijian Government, Dr. Michael worked for various UN agencies, the Pacific Islands Forum and the British Council. He currently is the co-chair of the Climate Investment Fund Board and the co-chair for the UNFCCC Ocean-Climate Dialogue. Dr. Michael is Fiji's Chief Negotiator for the Plastics Treaty, UNFCCC COP29 and UNCBD COP16.

ABSTRACT

Health at the Centre: Why the Global Plastics Treaty Must Address the Full Life Cycle of Plastics

Sivendra Michael[1]

[1] Fijian Government, Environment and Climate Change

Plastic pollution is increasingly understood not only as an environmental challenge but as an emerging human health issue. As scientific evidence advances on exposure pathways, chemical additives, and long-term biological impacts, the center of gravity in global plastics governance is shifting from waste management toward prevention and product design.

The keynote address will reflect perspectives from a Small Island Developing State and from ongoing negotiations toward a legally binding global plastics treaty. For countries such as Fiji, which import rather than produce most plastic products, the impacts of plastics are experienced across the entire value chain from product safety and chemical exposure to waste management constraints and marine ecosystem contamination. These realities highlight the limits of downstream solutions and the need for international measures that address production, product composition, transparency, and financing for implementation.

The presentation will connect current scientific themes — inventory, exposure, toxicology, epidemiology and policy — to their practical implications in treaty negotiations. Further, the speaker will outline why credible global governance must move beyond recycling and end-of-pipe measures toward upstream controls, chemical transparency, and equitable support for implementation, particularly from the perspective of Pacific Small Island Developing States.

PROFESSOR MARTIN WAGNER
Norwegian University of Science and Technology (NTNU)

Martin is a Professor of Environmental Toxicology at the Norwegian University of Science and Technology (NTNU) in Trondheim. His research aims at understanding how plastics, including microplastics and plastic chemicals, affect biodiversity, health, and society, working at the interface of ecology, toxicology, and chemistry. Passionate about solving the issue of plastic pollution, Martin actively communicates his research and advises policymakers, including in the negotiations for a global plastics treaty. He earned his PhD from Goethe University Frankfurt, Germany, in 2013 for research on endocrine-disrupting chemicals in plastics, where he later led a junior group studying freshwater microplastics. Since 2017, he has continued his plastic pollution research at NTNU. Learn more at www.biotox.de.

ABSTRACT

Mapping the chemical complexity of plastics: Moving from knowns to unknowns

Martin Wagner[1]

[1] *Department of Biology, Norwegian University of Science and Technology (NTNU)*

In this presentation, I will share insights from a large-scale exercise to map the known chemicals in plastics that resulted in the creation of the PlastChem database and then move on to discuss approaches to characterize unknown plastic chemicals. Reviewing the existing evidence that associates chemicals with plastics, I will discuss the identities, functions and presence of known plastic chemicals as well as the question how chemicals of concern in plastics can be identified and managed. I will also highlight information gaps and the associated challenges.

Since our work on PlastChem only addresses the known part of the issue, I will present results from our ongoing activities to understand the chemical complexity of plastics holistically, including case studies on non-target high-resolution mass spectrometry to elucidate all plastic chemicals and effect-based approaches to understand the toxicity of plastic leachates. I will wrap up the presentation by reflecting on pathways towards creating safer plastics, a key prerequisite for a sustainable plastics economy. I will also reflect on the role the scientific community can play in this transition.

keynote speakers

DR CASSANDRA RAUERT
The University of Queensland

Dr Cassandra Rauert is a Senior Research Fellow at the Queensland Alliance for Environmental Health Sciences (QAEHS), The University of Queensland, and is the microplastics research lead at the Minderoo Centre – Plastics and Human Health. Her primary research focusses on assessing human exposure to microplastics/nanoplastics and developing methods for detecting plastics in human matrices. She also leads various environmental exposure research projects including assessing the impact of tyre road wear particles and their associated chemicals on the urban environment.

ABSTRACT

Analytical challenges with human biomonitoring of micro/nanoplastics: Bombshell or progression of science?

Cassandra Rauert[1,2,3], Elvis Okoffo[1,3], Grace Davies[1,2], Fatma Nur Eraslan[1,2], Nathan Charlton[1,2], Angus Bagley[1,2], Christos Symeonides[1,2,4], Sarah Dunlop[1,2,4], Kevin V. Thomas[1,2,3].

[1] Queensland Alliance for Environmental Health Sciences (QAEHS), The University of Queensland, Woolloongabba, Australia
[2] Minderoo Centre – Plastics and Human Health, The University of Queensland, Woolloongabba, Australia
[3] ARC Training Centre for Hyphenated Analytical Separation Technologies (HyTECH), QAEHS, The University of Queensland, Woolloongabba, Australia
[4] Minderoo Foundation, Perth, Western Australia, 6009, Australia

It is globally recognised that micro and nanoplastics (MNPs) are pervasive in the environment and that we are continually exposed to these contaminants. As such, scientific, public and regulatory interest in our exposures has dramatically increased since the term 'microplastic' was popularised 2004. More recently, there has been increasing interest in human biomonitoring studies, primarily aimed at determining links with adverse health outcomes. But has the jump to human biomonitoring studies raced ahead too quickly? Do we have access to the methods or analytical techniques needed to be able to provide these links confidently? This keynote presentation will discuss the analytical developments in the field of microplastic analysis, current challenges and limitations that the field faces, with a discussion of what a collaborative path forward that improves the science may look like.

PROFESSOR DA CHEN
Jinan University

Da Chen is a Professor and Dean of the College of Environment and Climate, Jinan University. He graduated from The College of William and Mary (U.S.) with a Ph.D. in marine science and conducted post-doctoral research at the National Wildlife Research Centre, Environment and Climate Change Canada. His research focuses on the development of advanced analytical techniques to characterize human exposure to contaminants of emerging concern (including organic compounds and micro/nano-plastics) and explore potential human health risks from contaminant exposure. He has published more than 240 papers in premier scientific journals such as Nature Sustainability, PNAS Nexus, Advanced Science, Environmental Health Perspectives, and Environmental Science & Technology. He is currently an Associate Editor for Environment International and Journal of Environmental Exposure Assessment. He has been awarded with National Environmental Protection Science and Technology Award and several other provincial or organisational awards.

ABSTRACT

Environmental distributions and health risks of emerging plastic additives

Da Chen[1]

[1] College of Environment and Climate, Jinan University, Guangzhou, China

Plastic goods usually contain a large diversity of industrial chemicals as additives to enhance the functions and lifespan. They commonly include plasticizers, flame retardants, UV stabilizers, antioxidants, and others. These chemicals may be released to the environment during the entire life cycle of plastic goods, including the production, use, and disposal stages. However, knowledge on the environmental distribution of many plastic additives, particularly the emerging substances used as replacements for the legacy ones, remains limited worldwide. More lacking is the understanding of human exposure to emerging plastic additives and subsequent health risks. In this study, we used house dust as a representative environmental sample to investigate the profiles and distribution of emerging plastic additives in indoor environment across China. Gestational exposure to these chemicals was investigated in pregnant women, along with their transplacental transfer potency and potential impact on birth outcomes. Our study lays a solid ground for further elucidation of emerging plastic additives with respect to their environmental and human health risks.

keynote speakers

ASSOCIATE PROFESSOR PHOEBE STAPLETON
Rutgers University

Dr. Phoebe Stapleton is an Associate Professor in the Pharmacology and Toxicology Department of the Ernest Mario School of Pharmacy and a resident member of the Environmental and Occupational Health Sciences Institute of Rutgers University. She completed both her graduate and postdoctoral training at West Virginia University focusing on microvascular physiology and inhalation toxicology, respectively. Her laboratory focuses on the cardiovascular implications of maternal exposure to nano-sized particles during pregnancy, identifying the maternal, fetal, and offspring outcomes associated with these exposures. Most recently, she has focused on the effects of micro- and nanoplastic exposures during pregnancy.

ABSTRACT

There's a little Barbie in all of us (nanoplastics), but is there cause for concern

Phoebe A. Stapleton[1,2]

[1]Department of Pharmacology and Toxicology, Ernest Mario School of Pharmacy, Rutgers University, Piscataway, NJ;
[2]Environmental and Occupational Health Sciences Institute, Rutgers University, Piscataway, NJ

Micro- and nanoplastic particles (MNPs) are a ubiquitous environmental pollutant. These particles have been identified and measured in all environments: rural/urban, outdoor/indoor, marine/terrestrial, plants/animals, organic/processed foods, tap/bottled water, and biological tissues. As it pertains to human tissues, MNPs have been identified in every tissue assessed, breaching epithelial and systemic biological barriers. While there are discussions regarding the concentrations of MNP deposition, there are no conflicts regarding the fact that MNP have invaded our bodies. This keynote will focus on the identification of MNP within human organ systems, models of exposure and assessment, concerns associated with the application of a toxicological paradigm or framework to study MNPs, high-throughput considerations, and future directions to assess the physiological implications of MNP exposures. To properly address this human health concern considerations of environmental exposure vs in situ dose, sample contamination, cellular and systemic transport, and diseased vs healthy sample collections must be transparent and at the forefront. Add to this co-variables including polymer type, particle weather and surface conditions, chemical adsorptions, bioaccumulation, and credible reproducibility and the study design transformations increase exponentially. To tackle these datasets and translate the outcomes into policy, high-throughput assessments and data integration strategies must be developed and employed. Overall, this talk will synthesize current toxicological approaches, advancements and considerations in the assessment of MNP exposure and health concerns.

DR SHOJI NAKAYAMA
National Institute for Environmental Studies

Dr Shoji Nakayama holds MD and PhD degrees. He is certified as Public Health Specialist/ Supervisor by Japan Board of Public Health and Social Medicine. He serves Associate Editor of Environment International as well as Journal of Exposure Science and Environmental Epidemiology. In 2005, Dr Nakayama was invited by the US Environmental Protection Agency and spent 6 years to conduct exposure research on contaminants of emerging concern. In 2011, Dr Nakayama joined the National Institute for Environmental Studies in Japan. Currently he is Deputy Director of the Japan Environment and Children's Study Programme Office. He also holds Professor title at the St. Luke's International University, the University of Tsukuba and Icahn School of Medicine at Mount Sinai. Dr Nakayama is a lead exposure scientist for the Japan Environment and Children's Study (JECS), which is a longitudinal birth cohort study involving 100,000 mothers and children. He is devoted to human biomonitoring research. Exposome research is his most recent activity. He collaborates with US, Canada, EU and Asian researchers to advance and promote children's environmental health.

ABSTRACT

A Decade of Epidemiological Insight from JECS: Plastics-Associated Chemicals, Human Exposure and Health Risks in a National Birth Cohort

Shoji F. Nakayama[1]

[1] National Institute for Environmental Studies, Japan

Plastics and their additives are ubiquitous across all environmental media, generating concerns regarding human exposure throughout their lifecycle. The Japan Environment and Children's Study (JECS), a nationwide birth cohort of approximately 100,000 mother–child pairs, provides a unique platform to evaluate exposures to plastic-related chemicals and their potential health effects from pregnancy through childhood. This review synthesizes JECS publications relevant to plastics and associated compounds—including phthalates, bisphenols, organophosphate esters, and related emerging contaminants—focusing on exposure assessment, health outcomes and policy implications. JECS has established one of the world's largest human biomonitoring datasets, integrating biospecimen measurements with extensive questionnaire and environmental data. Analyses have revealed widespread maternal exposure to multiple plastic additives, with associations observed for reproductive, endocrine, neurodevelopmental and immune endpoints. Several studies also highlight cumulative and mixture effects, as well as socioeconomic and behavioural determinants of exposure. Key insights include: (1) the need for improved analytical methods to detect low-level and complex mixtures of micro-/nanoplastics and additives; (2) evidence supporting early-life susceptibility to plastic-associated chemical exposure; and (3) the value of linking epidemiological data with toxicological and regulatory frameworks for risk prioritization. This review underscores the role of population-based monitoring in translating exposome research into actionable management of plastic-related health risks. JECS continues to contribute essential longitudinal data for understanding how everyday plastic use intersects with human biology, public health, and sustainable chemical governance.

keynote speakers

DR JANE MUNCKE
Food Packaging Forum Foundation

Jane Muncke holds a doctorate degree in environmental toxicology and a MSc in environmental science from the ETH Zurich. In 2012 she co-founded the charitable Food Packaging Forum Foundation (FPF) in Zurich, Switzerland. FPF is a research and science communication organization focusing on chemicals in all types of food contact materials. Before leaving academia, she was a scientific associate at Eawag, the Swiss Aquatic Science Institute, collaborating in various different research projects, including endocrine disruption in developing zebrafish. Jane has extensive experience as science communicator and presenter and teaches live communication skills to scientists.

ABSTRACT

Plastic Food Contact Materials: establishing safety, ensuring sustainability

Jane Muncke[1]

[1] *Food Packaging Forum Foundation*

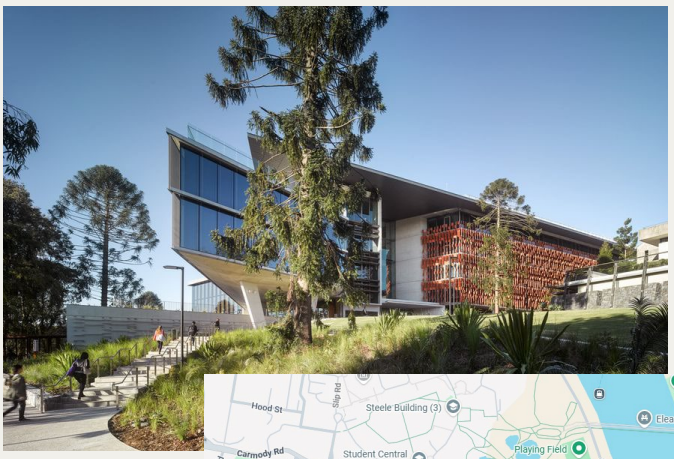
Plastics enable today's global economy but are an almost insurmountable challenge to manage: the expansion of plastic, especially in food packaging, has created a regulatory challenge of unprecedented scale as there are simply too many plastic chemicals to control using traditional chemical risk management approaches. With several thousand food contact chemicals known to be used in the manufacture of plastic food contact materials and articles, and many more forming during manufacturing, use, and recycling or reuse, huge data gaps characterize today's understanding of this materials' chemical composition. Advances in analytical chemistry and toxicology reveal the significant shortcomings of today's regulatory approaches to safety, calling for a new approach. Possible new approaches enable reliable tools such as mixture allocation factors to account for combined exposures, structure-based grouping for approximating hazard properties, effect-directed analysis for identifying specific chemical hazards for overall migrate, and a stronger focus on inertness as a key property for materials in direct contact with foodstuffs. Inert materials are set to become enablers of a safer and more sustainable economy that is based on the reduction of harm and overconsumption, for the benefit of public health and the environment.

VENUE MAPS

ADVANCED ENGINEERING BUILDING (AEB)

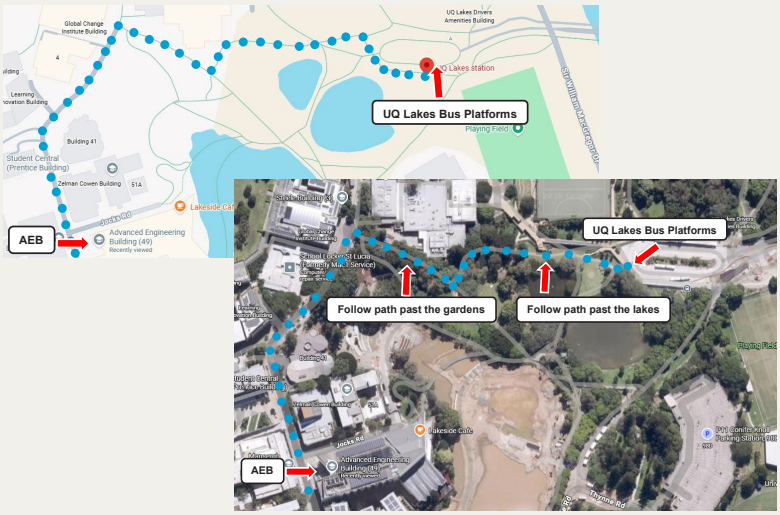
The University of Queensland, St Lucia, GHD Auditorium, Advanced Engineering Building (AEB).
Google Maps

When
Saturday 28 February 2026 - side events
Sunday 1 March 2026 - Welcome Event

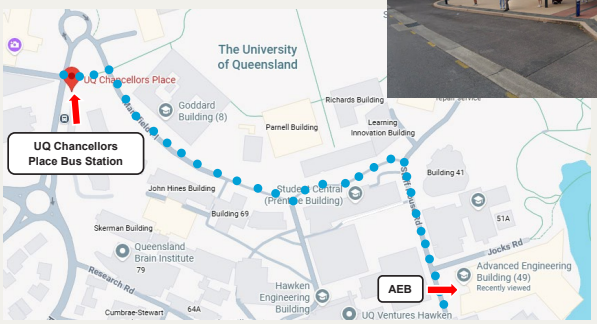


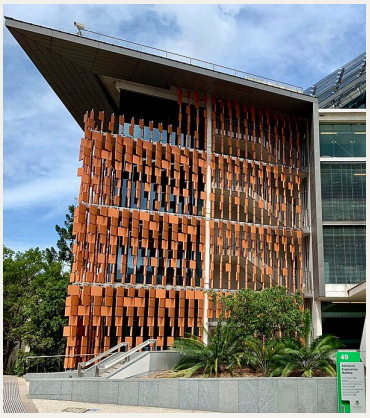
Accessing & Departing the AEB Via Public Transport (Bus)

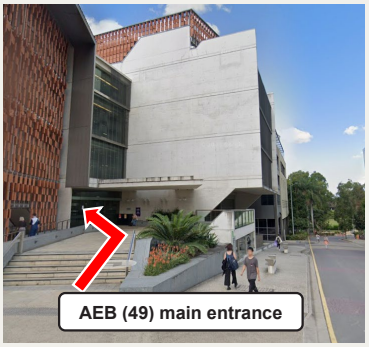
1. UQ Lakes Bus Station (Brisbane City Council Buses)
Inbound (to UQ) and outbound (from UQ) buses available. ~8-minute walk to AEB.



2. Chancellors Place Bus Station (Brisbane City Council Buses)
Inbound (to UQ) and outbound (from UQ) buses available. ~7-minute walk to AEB.







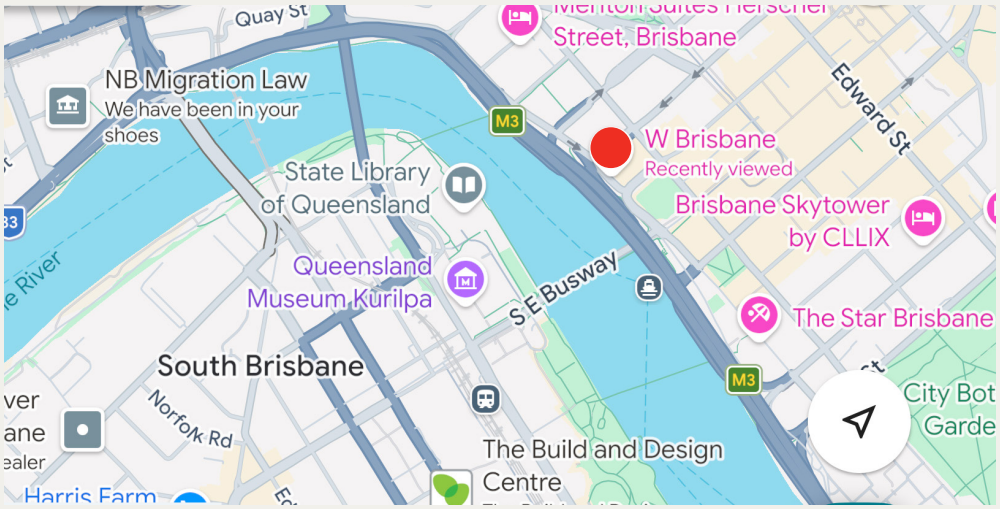
Accessing the AEB (Building 49), UQ St Lucia
Use the stairs (or ramp to the left of stairs) and turn left to enter the building via the main entrance on the corner of Staff House Road and Jocks Road.

venue maps

W HOTEL BRISBANE

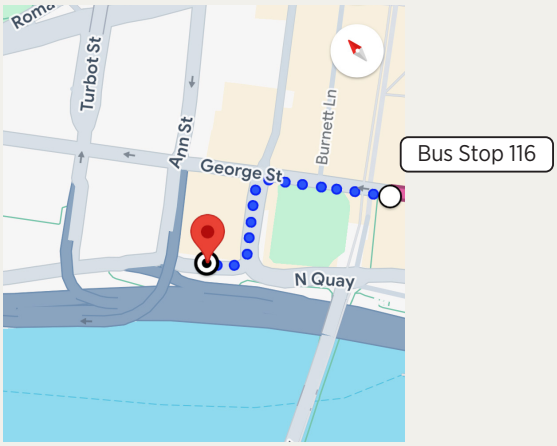
Great Room, W Hotel Brisbane,
81 North Quay, Brisbane.
Google Maps

When
Monday 2 March 2026 - Day 2
Tuesday 3 March 2026 - Day 3
Wednesday 4 March 2026 - Day 4



Accessing & Departing W Hotel via Public Transport

1. George Street, stop 116 (Brisbane City Council Bus). 5 minut walk to W Hotel.



venue maps

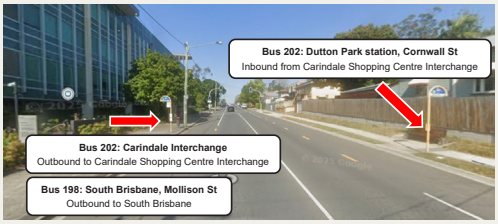
SUSAN TETT BUILDING

The University of Queensland
Queensland Alliance for Environmental Health Sciences, Level 3, 20 Cornwall Street, Woolloongabba.
Google Maps

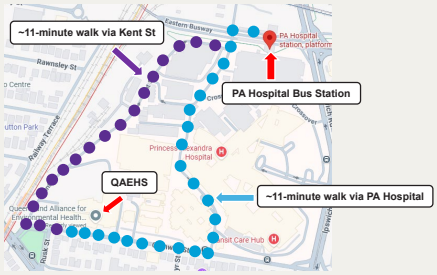
When
Thursday 5 March 2026 - Career Panel Session

Accessing & Departing QAEHS via Public Transport

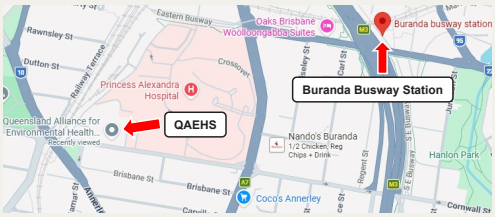
1. Cornwall Street at Rusk Street, stop 14a (Brisbane City Council Bus). Inbound and outbound buses available outside L3 reception.



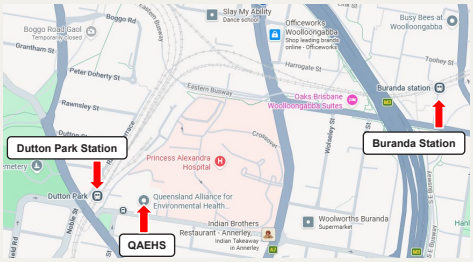
2. PA Hospital Bus Station (Brisbane City Council Bus) Many inbound and outbound buses available ~11 minute walk to/from QAEHS via PA Hospital or Kent Street

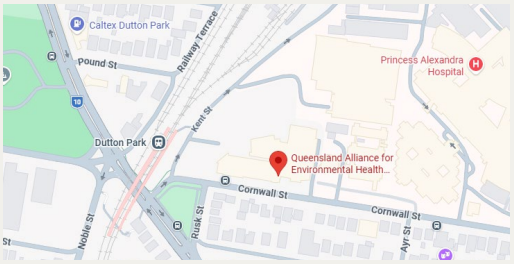


3. Buranda Busway Station (Brisbane City Council Bus) Many inbound and outbound buses available ~21 minute walk to/from QAEHS.



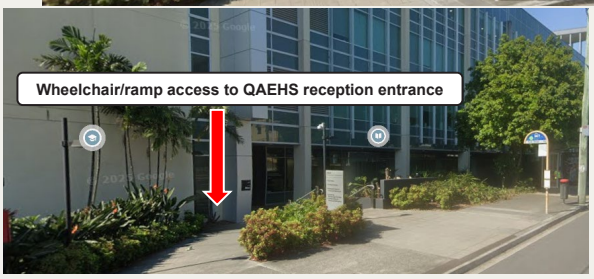
4. Queensland Rail Trains
Closest train stations: Dutton Park Station (~3 minute walk from QAEHS) & Buranda Station (~21 minute walk from QAEHS)
To get to QAEHS (from Brisbane City) via Dutton Park Station or Buranda Station, please change trains (i.e. catch a connecting train) at Roma Street Station.





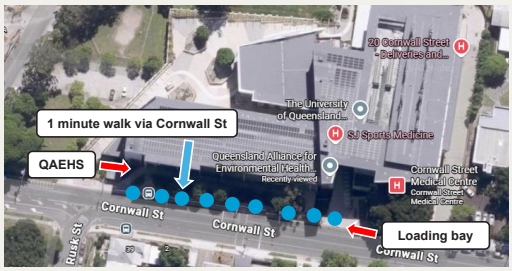
Accessing the QAEHS Reception Area (Level 3)

Please wait outside the QAEHS reception entrance - a designated team member will meet you here to provide access to the building.



Accessing & Departing QAEHS via Uber/Taxi

Loading bay outside of Cornwall Street Medical Centre that Uber/Taxi can utilise as a passenger pickup/drop off point (between blue and white striped poles).



logo

Miya Collective

miyacollective.com

To mark Plastics2026 in Brisbane, we partnered with Rebecca Salcole from Miya Collective, to incorporate elements of local Indigenous artwork into our conference logo. The result is a visual identity that celebrates place, culture, and collaboration.

The artwork speaks to connection, movement, and people coming together. The flowing lines hold a dual meaning, referencing the Brisbane River as it winds through the city and, at the same time, a journey or pathway that connects meeting places and people gathering. The work reflects movement across place, the sharing of knowledge, and continuing forward carrying what has been exchanged.

- Rebecca Salcole (Miya Collective).

Boomerang Bags Inc

boomerangbags.org

It was 2013, and Jordyn was working as a checkout chick on the Gold Coast. During the day she packed hundreds of plastic bags but then later when she was out surfing, would see them floating in the ocean. She and her friend Tania started a conversation about plastic and what they could do about it.

The answer stared them in the face, from the one million plastic bags being used every minute, the 10.46 million of tonnes of fabric waste created each year, and the willingness and generosity of people from all facets of society to do something about it. They created a platform that supports the diversion of post-consumer fabric (waste) into reusable bags to replace plastic bags and most importantly, start conversations.

When Boomerang Bags started, the bags were supplied free of charge to supermarkets, so customers who came in without a bag, could borrow one of our fabric bags and bring it back next time. Hence the Boomerang. The model has evolved and now reusable bags are either given away or sold for a minimal price.

The initiative spread enthusiastically, and is now in over 1100 Boomerang Bags communities worldwide. There is probably one near you! Have a look on the map on our website. Hundreds of thousands of plastic bags have been saved from landfill, and behaviour change went way beyond the bag to other single-use plastics and sustainable living. Not to mention the immeasurable social impact of the conversations, connections and new friendships created in the process!

https://youtu.be/nSkCHXQTY_s (TED Talk 2015)

Boomerang Bags Noosa

Boomerang Bags Noosa is a small NFP group of volunteers who sew sustainable, reusable bags from post-consumer textiles.

Using donated fabrics from individuals, offcuts from upholsterers and unneeded fabrics from Op Shops, we produce around 100 bags each week. Printing on the bags is done in-house and nothing is wasted, even our threads and offcuts are recycled to create footstools. As well as supplying bags to greengrocers, food stores and libraries, we also make heavier bags which are sold to newsagents and shops. Bulk orders are done annually for Ironman Australia, the Gympie International Film Festival and Noosa Malibu Club.

Profits have been donated to various organisations including Plastic Free Noosa, Find a Frog February and Katie Rose Cottage Hospice.

Although initially our aim was to remove plastic from supermarkets, once the government came on board we realised that it went even further. Over the last 10 years, we have made over 40,000 bags, saving over 4 tonnes of unwanted fabrics and plastics from landfill.

Our bags don't cost the earth!

https://youtu.be/M-aghDHuDSE

noosa biosphere AWARDS'24
Finalist – Sustainable Business Award 2024

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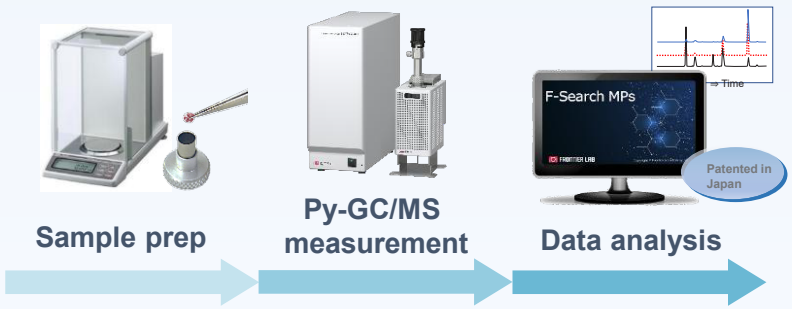

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danaher

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6.00 pm Doors Open to Public
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(15 min walk from conference)

Join us for light refreshments followed by an exclusive screening of *The Plastic Country*, featuring Kal Glanznig.

We'll be sharing a short 20-minute cut of the film, designed to highlight the scale of the plastics issue in Australia and explore how science and research are being applied to reduce impacts on everyday Australians.

Following the screening, we'll host a discussion on Plastics, Human Health & Action with:

Kal Glanznig – will share his reflections on the film, including the harms to his own health, the opportunities for change

Dr. Amelia Harray – will reflect her insights from work on the PERTH trial, which minimised dietary plastic exposure from paddock-to-plate, while supporting behaviour change

Dr. Cassandra Rauert – will discuss her understanding of how microplastics and chemicals leach from everyday products, and the challenges the scientific field currently faces in understanding health outcomes

With Sam Fricker as MC
Australian Olympic Diver and Eco-Entrepreneur.

ABSTRACTS

Quantifying the Hidden Plastic Burden: An Inventory of Plastic Materials and their additives in the Built Environment

- Teresa McGrath

Cassidy Clarity[1], Ryan Johnson[1], Rebecca Stamm[1], Teresa McGrath[1], Bethanie Carney Almroth[2], Veena Singla[3]

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The built environment is a major, yet under appreciated, contributor to global plastic pollution. From raw material extraction to manufacturing, installation, use, and end of life, plastic building materials contribute to plastic pollution in the form of hazardous chemicals emissions, greenhouse gas emissions, microplastics, and plastic waste. Plastic building materials also intensify building fires, release toxic constituents during combustion, and amplify pollutant loads in post-fire landscapes, compared to natural materials—posing an escalating threat as climate change fuels more severe wildfires. In this presentation, we share a comprehensive inventory of plastic building materials, including their common additives, and share low/ no plastic alternatives that are healthier for people and the planet. This presentation draws on decades of research on the contents of building products as well as the recent reports: Designing Out Plastics: A Blueprint for Healthier Building Materials (Habitable) and How Plastics Fuel Wildfires & How Communities Can Build & Rebuild Better (Plastic Pollution Coalition + Habitable). These reports highlight that the building and construction sector accounts for ~17 % of global plastic production, how leaders are taking steps to curb plastic use, and how communities can improve fire resilience by reducing the use of plastic building products. We will share building materials that use the most plastic and the most hazardous plastics, and participants will walk away with actionable solutions to reduce reliance on plastics. Ultimately, adopting a plastic-aware lens in the building sector can guide healthier design, regulatory prioritization, and strategies for reducing plastic pollution globally.

From Overview to Insight: Mapping Use, Exposure and Health Effects of Plastic Food Contact Chemicals

- Birgit Geueke

Birgit Geueke[1], Albert Anguera Sempere[1], Ahmed Elagali[2], Ksenia Groh[3], Christopher Kassotis[4], Maricel Maffini[5], Olwenn Martin[6], Lindsey Parkinson[5], Christos Symeonides[2], Helene Wiesinger[1], Lisa Zimmermann[1], Jane Muncke[1]

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[3] *Eawag*
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[5] *Independent consultants*
[6] *University College London*

Plastic food packaging is used to preserve food and extend shelf life, but it introduces 1000s of chemicals into the food and the environment. At least eight hundred food contact chemicals (FCCs) related to plastics are established to be hazardous, while many more remain largely untested for toxicity. The Food Contact Chemicals and Human Health project compiles FCCs (i) used in the manufacture of food packaging and other food contact articles, (ii) with empirical evidence of extraction and/or migration, (iii) detected in human samples, and (iv) with their links to human health effects. We address these questions systematically, including by using predefined searches of the primary scientific literature, eligibility screening, and standardized data extraction. In total, we have so far identified over 7600 plastic FCCs, of which 4554 are listed in global regulations, regulatory recommendations, and industry lists (Food Contact Chemicals Database, FCCdb). 1481 FCCs have been shown to migrate from plastic food contact articles, and a further 2215 FCCs have been detected in extracts only (FCCmigex database, v3). Among the chemicals with the highest evidence for migration are monomers, plasticizers, antioxidants and their degradation products, and oligomers. Based on these data, we mapped polymers to certain indicator chemicals. In human biological samples, 2184 plastic FCCs have been detected (FCChumon database). For both the FCCmigex and FCChumon databases, publicly available dashboards allow the exploration of data and sources. For some of these FCCs, especially those included in human biomonitoring programs such as NHANES and HBM4EU, a wealth of information linking chemical exposure to human health effects is available (e.g. for bisphenols and other phenols, phthalates, and PFAS). For other commonly found plastic FCCs, knowledge on human exposure and health effects is very limited or non-existent (e.g. antioxidants and oligomers), which suggests priorities for further research (ongoing FCChelix project). The FCC databases show the chemical complexity of plastic food contact articles and how they contribute to human exposure to plastic chemicals. These resources also support the investigation of specific research questions related to use, chemical occurrence, migration, exposure, and health outcomes. Addressing all plastic FCCs is essential to effectively protect human health and to inform future policy and innovation.

Hidden Chemistry: What Leaches from Our Clothing Microfibres?
- Amanda Dawson

Amanda Louise Dawson[1,2*], Edward Kerr[1], Sally Stockwell[1], David Beale[3], Pradeep Dewapriya[4], Utpal Bose[1,4], Cassandra Pegg[1]

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The textile industry produces over 100 billion garments annually, with 60% comprised of synthetic fibres. Chemicals are used at all stages of textile production, with additives, in particular, applied through manufacturing. These chemicals can leach from textile microfibres into the environment and potentially expose humans through ingestion and inhalation. This study employed untargeted mass spectrometry to characterize chemicals present in four garment types: recycled polyethylene terephthalate (rPET), polyethylene terephthalate (PET), polyamide (PA), and cotton. Dichloromethane extracts and aqueous leachates from cryomilled microfibres were analyzed, alongside leachates from simulated human gastrointestinal digestion. Solvent extracts revealed 944-1204 chemical features per garment type, with 15-30% significantly elevated above controls. Aqueous leaching yielded approximately 1250 features per textile, though only 7-15% exceeded control levels, indicating limited water solubility for most textile chemicals. Principal component analysis demonstrated distinct chemical profiles between fibre types, with rPET and PET showing notable similarity despite differences in manufacturing. Recycled PET contained elevated terephthalic acid (4.3-fold vs. PET), suggesting residues from the depolymerization recycling process. Tentative identifications included disperse dyes (6-fluorocoumarin), plasticizers (phthalates), processing aids, and water-repellent compounds including PFAS. Simulated gastrointestinal digestion released 17 features in the gastric phase and 121 in the intestinal phase, though most remained unidentified. Cotton fibres contained comparable numbers of concerning chemicals to synthetic textiles, challenging assumptions about natural fibres as universally safer alternatives. This study demonstrates that textile microfibres represent reservoirs of diverse chemicals with varying leaching potential, highlighting the need for greater transparency in textile chemical supply chains and further assessment of human exposure risks from microfibre ingestion.

Prioritization of Plastic-Associated Chemicals for Human Biomonitoring Using an Integrated Hazard–Exposure Framework
- Rui Wang & Jakub Maculewicz

Rui Wang[1], Jakub Maculewicz[1], Brad Clarke[1]

[1] Australian Laboratory for Emerging Contaminants (ALEC), The University of Melbourne, Australia

Plastic-associated chemicals represent a highly complex and rapidly expanding chemical space, yet systematic prioritization for human biomonitoring remains limited. In this study, we developed an integrated prioritization framework to identify plastic-related chemicals of potential relevance for blood and urine monitoring. Multiple curated databases, including PlastChem, FCCmigex, LitChemPlast, and recent suspect lists, were harmonized using InChIKey-based identifiers, yielding over 13,000 unique chemicals after filtration. A hazard characterization framework was established based on persistence, bioaccumulation, mobility, and toxicity (PBMT) criteria. Due to substantial data gaps, high-throughput QSAR predictions implemented via VEGA were applied to improve coverage. Exposure-related indicators, including production volume, migration evidence, and human detection, were incorporated alongside regulatory status. The combined scoring system produced a differentiated priority distribution, highlighting numerous high-hazard, high-exposure yet currently unregulated compounds. To improve transparency and usability, we developed an interactive online platform enabling traceable visualization of hazard, exposure, analytical feasibility, vendor availability, and regulatory information. While this framework provides a structured and practical prioritization strategy, we acknowledge that further refinement and validation are still required.

Target and non-target analysis of plastic flakes and pellets from Canadian recycling programs
- Derek Muir

Derek Muir[1], Leah Chibwe[1], Amila De Silva[1], Chris Spencer[1], Camilla Teixeira[1], Mary Williamson[1], Xiaowa Wang[1]

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Increasing global plastic production and pollution has prompted demand for greater use of recycled plastics. Only about 16% of plastic waste in Canada was recycled in 2022 which is slightly better than the 9% estimate for global recycling. There are concerns regarding contamination of recycled goods. In this study we present a broad screening of chemicals in plastic flakes and pellets provided by five Canadian recycling companies and intended for use in the production of recycled goods. Target and non-target (NTA) analysis was used to analyze perfluoroalkyl acids (PFAAs), organophosphorus flame retardants (OPFRs), brominated/chlorinated flame retardants (BFRs), other organic compounds, and metal(loid)s. The ∑OPFRs exhibited the highest concentrations (0.36-4700 ng/g) and detection frequencies (DFs) (5-100%) of the target chemicals, followed by the ∑BFRs (0-32 ng/g, DFs: 5-76%). ∑PFAAs were least detected at the lowest concentrations (0-0.70 ng/g, DFs: 5-19%). Over 200 NTA chemicals were identified as Level 1 (authentic standard) or 2 (library match), with estimated individual concentrations up to 1030 ng/g. Well known plastic additives were detected chemicals including, bisphenol A, phthalates and benzophenones, along with many non-intentionally added substances (NIAS). ∑Metal(loid) concentrations were between 0.005-2,980 mg/kg, with highest concentrations for calcium (2980 mg/kg), sodium (617 mg/kg) and iron (156 mg/kg). Collectively, >300 chemicals were detected suggesting potential for widespread contamination in recycled goods. The individual concentrations of the chemicals reported would be considered as unintentional trace contaminants, according to the European Union threshold limits for recycled granules and waste plastic flakes (500 ppm and 1000 ppm, respectively). However, these values do not reflect toxicological thresholds or effects from cumulative exposure to the many chemicals present. Our study highlights hazardous chemicals that could be used as indicators for screening for unwanted substances in recycled goods and products. In conducting the study we also identified knowledge gaps and barriers faced by the recycling industry and by regulators. These include, the lack of transparency and traceability of substances of high concern between waste producers and recyclers, the burden on recyclers to decontaminate materials from municipal waste collection programs, and the uncertainties in the regulations of NIAS or complex mixtures.

PlasticHealthAware: a dashboard for presenting up to date Umbrella Review data on plastic chemicals and health outcomes
- Yannick Mulders

Scott Cann[1], Christopher Carpenter[1], Tom Chiles[1], Henoch Kabeya[2], Aoife Lyons[2], Manheim Mack[1], Christopher Sonn[1], Christos Symeonides[2], Kul Thapa[1], Sarah Dunlop[2], Phil Landrigan[1]

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[2] *Minderoo Foundation*

Research effort into the effects of plastics is increasing exponentially, resulting in an ever-expanding knowledge base with more on effect of plastic chemicals and human health outcomes. While available systematic reviews with meta-analyses synthesize the findings of multiple studies into a more comprehensive summary of the evidence, they generally still only cover a limited selection of chemicals or health outcomes. Using traditional umbrella review methodology, the speed at which meta-analytical data can be synthesized is limited. Here, we present "PlasticHealthAware": a dashboard that leverages established peer reviewed methodology, but streamlines paper screening, data extraction, and analysis, presenting the findings in formats digestible for a range of audiences. The data driving PlasticHealthAware is sourced from 127 systematic reviews and pooled analyses published before August 2023, combining a total of 3296 meta-analyses. Seventy-four unique chemical exposures are identified, coming from 5 distinct plastic chemical groups: bisphenols, phthalates, polychlorinated biphenyls, polybrominated diphenyl ethers, and per- and polyfluoroalkyl substances. There is overarching consistent and significant evidence of harm from each of the 5 chemical groups on at least one broader health outcome category, such as the circulatory system, metabolic and endocrine system, child neurodevelopment, and pregnancy or birth outcomes. This dashboard consolidates the findings from peer-reviewed literature on plastic chemical exposure and its impacts on human health. Grounded in epidemiological research, it offers valuable insights into the effects of long-term, low-dose exposure resulting from everyday use, which is near unavoidable in modern life.

Operationalizing the plastic exposome with high-resolution mass spectrometry analytical workflows - Christian Dior Freeman

Douglas Walker[1], Kuanliang Shao[1], Christian Freeman[1], Ronald Smith[1], Parth Jariwala[1]

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Although plastic pollution has received worldwide attention, the health effects of exposure to complex plastic mixtures are largely unknown. To better understand plastic exposures in humans and potential health impacts, there is a critical need to develop robust and comprehensive methods for biomonitoring of microplastics (MPs) and plastic-related chemicals. Our team has developed a multi-platform high-resolution mass spectrometry (HRMS) workflow that incorporates rigorous QA/QC procedures to provide quantitative analysis of MPs while enabling deep screening for unknown/uncharacterized MP polymers, plastic-related chemicals, and co-transported chemicals to support population-scale research on characterizing the plastic exposome. Biological samples, including tissue and biofluids, are prepared for analysis using a simplified digestion and filtration procedure designed to remove matrix interferents while allowing quantitative recovery of MPs. Sample extracts are analyzed for MPs by double shot pyrolysis with gas-chromatography (GC) HRMS, while plastic-related chemicals are measured in solvent extracts using five different HRMS analytical configurations that include reverse phase and HILIC chromatography and GC-HRMS to provide detection of 60,000-100,000 chemical signals across all platforms. The resulting high-resolution, accurate mass spectra is analyzed using a hybrid targeted and untargeted screening approach that includes quantitation of 12 MP polymers, screening for 35 additional polymers, and identification of >1,000 plastic-related chemicals using authentic reference standards selected to match high-production volume chemicals listed within the PlastChem database. Application to multiple biological samples demonstrates this analytical framework greatly expands surveillance for biomarkers of plastic exposure while providing sensitive and selective detection of multiple MP polymers, additives used in the manufacturing of plastics, and their biotransformation products. Development of a robust and scalable analytical framework for measuring the plastic exposome is a critical first step to provide a robust foundation for studying complex plastic exposures in humans and their associated effects. Future efforts are focused on further increasing sample throughput using automated sample preparation and data processing approaches, and continued development of confirmed chemical databases for plastic-related chemicals.

Tracing the Sources of Laboratory-Origin Microplastic Contamination Using Polymer Fingerprinting - Karuna Singh (S)

Karuna Singh[1], Kapil Kumar[1], Naresh Kumar[2]

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Tracing the Sources of Laboratory-Origin Microplastic Contamination Using Polymer Fingerprinting Microplastic (MP) research often encounters analytical uncertainty due to contamination originating from laboratory environments, which can interfere with the environmental sources of MP. This study investigates and quantifies laboratory-derived MP contamination using a polymer fingerprinting approach. Potential contamination sources—including blank filters, laboratory air, and common consumables such as bottle caps, gloves, and lab coats—were analyzed to determine their polymeric composition, morphology, and abundance. Controlled blank experiments were conducted under both open-bench and closed (fumehood) conditions. All samples were examined microscopically and analyzed via Fourier Transform Infrared (FTIR) spectroscopy for polymer identification. The results revealed that polypropylene (PP), polyethylene terephthalate (PET), and polyamide (nylon) were the predominant polymers, collectively accounting for approximately 82% of all detected particles. Morphological classification showed that fibers (57%) and fragments (36%) were the most abundant particle types, with sizes ranging from 80 to 650 µm. Quantitative assessment indicated a mean background contamination level of 0.08 ± 0.02 MPs per filter under controlled conditions, with open-bench setups exhibiting up to 65% higher particle counts than those processed inside a fumehood. Among potential sources, PP fragments from bottle lids and centrifuge tubes, PET fibers from lab coats, and nylon filaments from protective clothing contributed most to airborne and procedural contamination. Following targeted mitigation—substitution of plastic consumables with glass alternatives, use of cotton apparel, and installation of localized air filtration—the contamination level declined by nearly 70%, validating the effectiveness of simple, low-cost interventions. These findings underscore that even in well-maintained laboratories, background MPs are non-negligible and can bias environmental MP quantification if unaccounted. The developed fingerprinting framework provides a robust diagnostic tool to trace, quantify, and minimize laboratory-origin contamination. Establishing such standardized QA/QC protocols enhances the reliability, reproducibility, and comparability of MP datasets, particularly in resource-constrained research environments, and supports global efforts toward harmonized microplastic monitoring.

Tools for Analysis of Environmental Fate of Nanoplastics in Various Types of Samples
- Maria Hayder (S)

Maria Hayder[1], Aleksandra Chojnacka[1], Gert-Jan Gruter[1,2], Annemarie van Wezel[3,4], Alina Astefanei[1]

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Plastic particles resulting from plastic degradation are a major environmental issue. The tools for identification, characterisation and quantification of nanoplastics (<1 µm, NPs) are urgently needed to boost research on their fate and toxicity. However, while for larger particles some methods are already established, NP characterisation remains immature. NPs appear in a variety of sizes, surfaces and polymer chemistries, while usually present in low concentrations in a complex environmental matrix. The analytical workflow must therefore be equally multi-dimensional. In this work we explore a set of tools for characterisation of NPs and their environmental fate. One technique for particle size measurement is Asymmetric Flow Field-Flow Fractionation with Multi-Angle Light Scattering detection (AF4-MALS). This non-destructive approach enables size separation and in-line cleanup. However, it does not provide information on analyte chemistry. We thus match AF4-MALS with Pyrolysis-Gas Chromatography-Mass Spectrometry (Py-GC-MS) and assess the possibilities and limitations of such an off-line coupling. We also consider Dynamic Light Scattering (DLS) and microscopy for NP analysis. We study two distinct types of samples: a) polymeric particles incubated in human gastrointestinal juice simulated in vitro for studying fate of NPs in the human organism after oral uptake; and b) untreated environmental waters for environmental screening. We identified varying difficulties in pretreatment and analysis of different sample types. In the in vitro studies, NPs require finely tuned, mild conditions. Those allowed to study NP aggregation with digestive enzymes, induced by the human digestive tract, which might decrease the risk of NP cellular uptake. For environmental water samples, the main challenge is to achieve a sufficient detection limit. Adding an in-line preconcentration step in the AF4 resulted in detection limits reaching microgram per litre. We quantified 8.8±1.8 ng/mL NPs with a continuous size distribution down to 250 nm in untreated wastewater. Our experiments show that AF4 can also remove salt from the samples, facilitating Py-GC-MS analysis of NPs in seawater. Our research proves that no single technique can successfully characterise and quantify NPs. Combining AF4-MALS, Py-GC-MS and other tools allows for analysis of NPs from diverse sources. We believe this work will contribute to more feasible NP analysis and to state-of-the-art pollution monitoring.

Toward In-Situ Microplastic Detection Using Broadband Excitation Spectroscopy and Machine Learning
- Nico Merck (S)

Nico Merck[1], Jonas Otto[1], Nils Damaschke[1]

[1] *University of Rostock/Institute of General Electrical Engineering/Chair for Optoelectronics and Photonic Systems*

Microplastic (MP) contamination has been reported not only in marine habitats but also in drinking water, tea bags, bottled beverages, and even medical infusions, raising growing concern about human exposure. Yet, current detection methods such as Raman and FTIR spectroscopy, while chemically specific, require complex instrumentation and laborious sample preparation, preventing real-time, large-scale assessment. Reliable evaluation of MP occurrence therefore demands in-situ techniques capable of continuously monitoring particles in flow, under realistic environmental and technical conditions. Building on our previous proof-of-concept study demonstrating fluorescence-based identification of polypropylene (PP) MP particles with intrinsic dyes under flow conditions, we extend this concept toward more general, excitation-spectroscopy based detection. The earlier work demonstrated that interferometric particle imaging distinguishes solid PP particles from air bubbles, while laser-induced fluorescence spectroscopy identifies intrinsic fluorescent dyes in PP, together providing a physical basis for contact-free, real-time monitoring. In this follow-up study, broadband excitation spectroscopy was evaluated as a simple and cost-effective approach to plastic classification under controlled laboratory conditions, serving as an intermediate step toward in-situ deployment. A broadband gas-discharge lamp (215–500 nm) provided excitation, and automated spectral acquisition yielded about 5,000 spectra (201–647 nm) across 19 classes comprising 15 plastics and four non-plastic references. To handle the data's high dimensionality and collinearity, complementary machine-learning strategies were applied: dimensionality-reduction pipelines to mitigate redundancy arising from strongly correlated spectral features, and convolutional neural networks to directly learn these correlations. A two-stage scheme distinguished plastics from non-plastics and further classified subtypes using two separate classifiers, validated by 10-fold cross-validation. The classification achieved mean accuracies of about 99 % for both plastic vs. non-plastic discrimination and subtype identification. These results demonstrate that broadband excitation spectroscopy combined with data-driven analysis can in principle provide the foundation for continuous, in-situ MP monitoring, which is an essential prerequisite for reliable exposure assessment in environmental and human health contexts.

FTIR spectroscopy methods to elucidate the interactions between microplastics and cells
- Helena Friedrich (S)

Helena Friedrich[1,2], Jizhou Zhong[1], Carolin Borbeck[2], Miriam Unger[2], Hendrik Vondracek[3], Mark Frogley[3], Gianfelice Cinque[3], Ka Lung Andrew Chan[1]

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[3] *Diamond Light Source*

Micro- and nanoplastics (MNPs) are widespread pollutants, found in human organs due to continuous exposure via air and contaminated food and drink. They have been associated with inflammatory and toxic effects on cells, raising concern for human health. Establishing methods which can detect MNPs in biological materials and directly correlate them to their impact on the cell is important to better understand their cellular fate, biochemical effects, and mode-of-action. FTIR spectroscopy is a fast, label-free, and non-destructive tool, which is sensitive in detecting the effects of xenobiotics on cells, but is not yet fully explored in studying the biological impact of MNPs at a cellular level. In this work, we used 3 different FTIR-based methods to observe the effects of MNPs at single-cell, subcellular, and single-MNP level: Live-cell FTIR microscopy using ZnS immersion lenses, developed in our laboratory, allows sufficient magnification for single cell analysis with a standard benchtop IR microscope. Around 60 live cells per MNP type could be measured from 5 biological replicates, which allows us to analyze the metabolic effects at both single cell and cell population level. Distinguished spectral biomarkers for inflammation and different uptake pathways could be detected, even for non-toxic MNPs. The results can guide the most suitable subsequent analysis steps, such as biochemical assays or lipidomics. O-PTIR spectroscopy makes use of the photothermal effect with an optical laser detection scheme, therefore providing spatial resolution down to ~ 500 nm with the ability to acquire both IR and Raman spectra from the same sample. This method allows us to simultaneously resolve MNPs in cells, as well as give information on the distribution of various biological components throughout the cell. With this method, MNPs were shown to be taken up in lipid vesicles in cells in a label-free manner for the first time. The co-located Raman spectroscopy allows the detection of even smaller, more embedded MNPs in the cell matrix. Finally, we demonstrated the world-unique Synchrotron radiation AFM-IR (SR-AFM-IR) spectroscopy, which uses the photothermal expansion of the samples to provide spatial resolution down to ~ 100 nm. For the first time, we have detected sub-micron plastic particles in cells via IR, while providing information on the biological composition of the cell around the MNP and highlighting the plastic-cell interactions at the interface.

Development and validation of a Raman microspectroscopy workflow for the detection of micro- and nanoplastics in human blood
- Alena Vdovchenko (E)

Alena Vdovchenko[1], Stephanie Wright[1]

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Plastic pollution represents one of the most pressing environmental challenges of our time. Plastic can break down into fragments known as micro- and nanoplastics (MNPs), particles smaller than 5 mm, through environmental degradation and mechanical abrasion (e.g. from tyres). These particles infiltrate food, water, and air, and can enter the human body through ingestion and inhalation [1]. Evidence from pyrolysis gas chromatography–mass spectrometry (pyr-GC/MS) indicates the presence of MNPs in human blood [2]. While pyr-GC/MS is a powerful tool for chemical identification, it is inherently destructive and does not provide information on particle morphology, size, or surface characteristics; properties which are influential in the likelihood of translocation. Moreover, its capacity to detect co-polymers, additives, or less common polymer types is limited, creating uncertainty when assessing human exposure, biodistribution, and potential effects. In this work, we developed and validated a Raman microspectroscopy-based workflow for the detection and characterisation of MNPs in human blood. Raman microscopy integrates optical imaging and molecular spectroscopy with a capability to detect nanoparticles down to 100-300 nm [3]. The protocol includes digestion of 1 mL of whole blood, evaluation of environmental contamination, assessment of potential interferences from the biological matrix and statistical analysis. An example of biological interference includes lipid droplets with Raman spectra matching the reference spectrum of ethylene–acrylic acid copolymer in the database by >80%, while the presence of characteristic cholesterol peaks suggested its biological origin. Method validation was performed for MNPs at concentrations of 0.1 – 1 µg/mL reported in human blood by pyr-GC/MS [2]. The method was applied to the analysis of MNPs in blood from healthy donors (n = 5). Several polymer types that can be tracked to tyre wear, coatings and personal care products were detected at low counts (< 10) and were absent in long-term procedural blanks, suggesting a possible association with blood samples. I will discuss the analytical performance of the method, preliminary findings from donor samples, and potential implications for understanding human exposure. Limitations of the approach and future applications in large-scale biomonitoring will also be addressed. [1] DOI 10.3390/ijms25137074 [2] DOI 10.1186/s43591-024-00090-w. [3] DOI 10.1016/j.watres.2020.115658.

Analytical advances in mass spectrometry–based detection and quantification of micro- and nanoplastics in human matrices

- Federica Nardella (E)

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Micro- and nanoplastics (MNPs), defined as solid particles ranging from 5,000 µm down to <1 µm, are increasingly detected in food, water, air, and, ultimately, within the human body. Assessing their presence in human tissues and biological fluids is critical for evaluating exposure and understanding potential health implications. Although growing evidence reports MNPs in biological fluids such as blood and in tissues, their reliable quantification remains difficult due to the complexity of biological matrices and the demand for analytical techniques with high sensitivity. A key obstacle is sample preparation: organic matrix must be efficiently digested without compromising particle integrity, while minimizing matrix effects, interferences, and losses. Methods must also be adaptable to the wide compositional variability of biological fluids (e.g., blood, bile) and tissues (e.g., liver, placenta). To address these challenges, we present recent advances in analytical methodologies for the quantification of MNPs in complex human matrices. Our work focuses on the continuous optimization of a pyrolysis–gas chromatography–mass spectrometry (Py-GC-MS) workflow for the quantification of widely used polymers. To ensure analytical robustness and reproducibility, rigorous quality-assurance and quality-control (QA/QC) procedures—including contamination control and comprehensive method validation—are systematically implemented. In parallel, we are exploring novel high-resolution mass spectrometry (HRMS) strategies to enhance selectivity, sensitivity, and minimize effects. This includes the implementation of direct analysis in real time (DART) and the evaluation of alternative ambient ionization techniques coupled with quadrupole time-of-flight (QTOF) and trapped ion mobility spectrometry (TIMS-TOF) systems. These developments aim to enable rapid and direct polymer characterization and quantification. These methodological developments represent an important step toward establishing sensitive and standardized approaches for assessing MNPs in human tissues and biological fluids, ultimately supporting a more comprehensive understanding of their potential effects on human health.

Exploring the potential of one-pot microwave-assisted pretreatments coupled with PY-GC-MS for the quantification of MPs and associated contaminants

- Alessio Gomiero

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Microplastic pollution is now recognized as a global environmental threat and one of the most urgent challenges for ecosystems and human health. MPs not only persist in the environment but also act as carriers of chemical species, including additives, persistent organic pollutants, and polymer degradation products. Despite numerous studies, there is still limited understanding of how MPs and associated contaminants interact with organisms and ecosystems. A variety of analytical techniques have been developed to study MPs and co-occurring pollutants. Among these, pyrolysis-based methods have proven particularly effective, as they allow mass-based quantification of different polymers together with the identification of associated organic contaminants. However, the analysis often requires labor-intensive pretreatments that vary depending on the complexity of the environmental or biological matrix. To address the limitations of conventional multi-step sample preparation, microwave-assisted extraction and digestion were evaluated as efficient alternatives. The approach integrates microwave-assisted extraction with thermal desorption and pyrolysis–gas chromatography–mass spectrometry, enabling the characterization and quantification of several classes of pollutants, including phthalate plasticizers, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and contaminants of emerging concern. In parallel, the same samples were subjected to microwave-assisted digestion, optimized to reduce polymer degradation while allowing reliable quantification of microplastics. This combined workflow provides a rapid and comprehensive overview of both polymeric and non-polymeric contaminants within complex biological matrices. Even though current methods enable the characterization of microplastics (MPs) and associated contaminants, they generally do not allow the analysis of both classes of compounds starting from the same sample. To overcome this limitation, a one-pot microwave-assisted pretreatment was optimized to provide a comprehensive overview of MPs and co-occurring contaminants within a single workflow. This rapid and integrated method reduces sample preparation time, improves efficiency, and opens the way for applications to other biological matrices, including human samples. Such developments are essential for assessing MP exposure and co-contaminant burdens, with direct implications for environmental risk assessment and public health research.

Analytical method development, optimisation, and evaluation for the detection and quantification of plastic oligomers in human blood

- Alexandra Richardson (E)

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Plastics are one of the most abundant materials in our modern daily life and are used globally across different applications. Plastic oligomers – short-chain monomers, typically less than 40 repeating units and 1,000 Da in size – are understudied byproducts of plastic manufacturing and degradation. Oligomers are considered more bioavailable than micro- and nano-plastics due to their small size and increased solubility, potentially enabling them to more readily cross membranes, be absorbed into the bloodstream, and enter cells. To date, there is limited human biomonitoring data for plastic oligomers available, but this provides an opportunity to explore questions relating to the adverse health effects of oligomer exposure. As a first step towards understanding human exposure, a sample preparation and liquid chromatography-mass spectrometry (LC-MS/MS) analytical method was developed and optimised for the rapid identification and quantification of plastic oligomers in human blood. The analytical method was validated as per the Eurachem Fitness of Purpose of Analytical Methods for limits of detection and quantification, linearity, accuracy, and precision (inter- and intra-day). The recovery and matrix effects of different low-volume (250 µL) blood extraction procedures were assessed and compared. Interferences and contamination sources from various laboratory and sample collection consumables (blood collection consumables, pipette tips, LC & Eppendorf vials, extraction solvents, etc.) were identified and minimised. Oligomer stability in whole blood and extracts were assessed under freezer storage conditions (whole blood: -80^{0}C, extracts: -20^{0}C), through multiple freeze-thaw cycles, and in the LC autosampler. The developed method was then applied to real human blood samples to assess the impact of different blood types on analytical performance and investigate the background occurrence of oligomers across various demographics. This work vitally underpins future biomonitoring studies investigating the human health impacts of plastic oligomers.

Addressing low-concentration BPA quantification challenges in urine samples using a native analyte addition method

- Xianyu (Fisher) Wang (E)

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Plastic pollution represents one of the most pressing environmental challenges of our time. Plastic can break down into fragments known as micro- and nanoplastics (MNPs), particles smaller than 5 mm, through environmental degradation and mechanical abrasion (e.g. from tyres). These particles infiltrate food, water, and air, and can enter the human body through ingestion and inhalation [1]. Evidence from pyrolysis gas chromatography–mass spectrometry (pyr-GC/MS) indicates the presence of MNPs in human blood [2]. While pyr-GC/MS is a powerful tool for chemical identification, it is inherently destructive and does not provide information on particle morphology, size, or surface characteristics; properties which are influential in the likelihood of translocation. Moreover, its capacity to detect co-polymers, additives, or less common polymer types is limited, creating uncertainty when assessing human exposure, biodistribution, and potential effects. In this work, we developed and validated a Raman microspectroscopy-based workflow for the detection and characterisation of MNPs in human blood. Raman microscopy integrates optical imaging and molecular spectroscopy with a capability to detect nanoparticles down to 100-300 nm [3]. The protocol includes digestion of 1 mL of whole blood, evaluation of environmental contamination, assessment of potential interferences from the biological matrix and statistical analysis. An example of biological interference includes lipid droplets with Raman spectra matching the reference spectrum of ethylene–acrylic acid copolymer in the database by >80%, while the presence of characteristic cholesterol peaks suggested its biological origin. Method validation was performed for MNPs at concentrations of 0.1 – 1 µg/mL reported in human blood by pyr-GC/MS [2]. The method was applied to the analysis of MNPs in blood from healthy donors (n = 5). Several polymer types that can be tracked to tyre wear, coatings and personal care products were detected at low counts (< 10) and were absent in long-term procedural blanks, suggesting a possible association with blood samples. I will discuss the analytical performance of the method, preliminary findings from donor samples, and potential implications for understanding human exposure. Limitations of the approach and future applications in large-scale biomonitoring will also be addressed. [1] DOI 10.3390/ijms25137074 [2] DOI 10.1186/s43591-024-00090-w. [3] DOI 10.1016/j.watres.2020.115658.

Identification and prioritisation of chemical additives in plastic products using TGA coupled to GC/QTOF-MS

- Sijing Li (E)

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Thermal decomposition or desorption techniques coupled to GC/MS has become a popular method of choice for characterising plastics. In particular, pyrolysis-GC/MS method is widely used for quantification of nano- and micro-plastics in environmental and biological samples. Building on these approaches, this study aims to extend the method to analysing a broad range of commercial plastic products and to generate a curated reference of chemical additives which may leach into environment. First, thermal gravimetric analysis (TGA) was used to define the thermal mass-loss profile of each plastic sample, identifying weight-loss stages corresponding to additive desorption and polymer decomposition. At each critical temperature interval, evolved gases were trapped via a solid-phase sorbent and subsequently analysed by gas chromatography quadrupole time-of-flight mass spectrometry (GC/QTOF-MS). Separate adsorbers were deployed to distinguish between thermal desorption (additive release) at lower temperature and polymer decomposition products released at higher temperature. The high-resolution mass spectra facilitate both suspect screening and non-targeted analysis of unknown species. We applied this workflow to a range of commercial plastics (e.g., a PE stretch-wrap film, a recycled PET cup-lid, and a controlled-release fertiliser shell of unknown composition) to profile both thermally desorbed additives and decomposition markers. Through cross-comparison with the PlastChem database, additive identifications were annotated with toxicological metadata and prioritised for environmental relevance. Ultimately, ~100 plastic products will be characterised during the current project, culminating in the development of a reference database of both additive species and polymer decomposition compounds. This reference is intended to underpin future qualitative and quantitative analyses of micro- and macro-plastics and their associated chemicals in environmental samples.

Ongoing exposure to endocrine disrupting plasticizers in neonatal intensive care unit patients - Adrian Covaci

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Due to endocrine disrupting effects, di-(2-ethylhexyl) phthalate (DEHP), a plasticizer used to soften plastic medical devices, was restricted in the EU Medical Devices Regulation (EU-MDR-2017/745) and gradually replaced by alternative plasticizers. Neonates hospitalized in the neonatal intensive care unit (NICU) are vulnerable to toxic effects of plasticizers. From June 2020 to August 2022, urine samples (n=1070) were repeatedly collected from premature neonates (n=132, 4–10 samples per patient) born at <31 weeks gestational age and/or <1500 g birthweight in the Antwerp University Hospital, Belgium. Term control neonates (n=21, 1 sample per patient) were included from the maternity ward. Phthalate and alternative plasticizers' metabolites were analyzed using liquid-chromatography coupled to tandem mass spectrometry. Phthalate metabolites were detected in almost all urine samples. Metabolites of alternative plasticizers, di-(2-ethylhexyl)-adipate (DEHA), di-(2-ethylhexyl)-terephthalate (DEHT) and cyclohexane-1,2-dicarboxylic-di-isononyl-ester (DINCH), had detection frequencies ranging 30–95%. Urinary phthalate metabolite concentrations were significantly higher in premature compared to control neonates (p=0.023). Exposure during the NICU stay to respiratory support devices and blood products led to increased phthalate metabolite concentrations (p<0.001), from birth until four weeks postnatally. The estimated phthalate intake during the NICU stay exceeded animal-derived-no-effect-levels (DNEL) in 10% of samples, with maximum values reaching 24 times the DNEL. Also 29% of premature neonates had at least once an estimated phthalate intake above the DNEL. Preterm neonates are still exposed to phthalates during NICU stay, despite the EU Medical Devices Regulation. Alternative plasticizers, currently not regulated and with insufficient knowledge on their hazard profile showed increasing exposure in the NICU. Cumulative NICU exposure to phthalates and alternative plasticizers was associated with increased respiratory effects and eczema during the first year of life. Exposure to specific plasticizer mixtures correlated with worse or better neurodevelopment at one year of age.

Assessment of infant oral exposure to micro and nanoplastics from plastic feeding and storage containers - Laura Puente-De La Cruz (S)

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Current understanding on infant exposures to micro and nanoplastics (MNPs) is vastly limited, despite its importance in terms of potential risk. Infants have immature immune systems and lower body mass which makes them more susceptible to potential adverse health outcomes. Initial studies have suggested that plastic containers such as feeding/storage bottles and breast milk storage bags may be sources of microplastic (MPs, > 1µm) ingestion, while nanoplastic (NPs, < 1µm) exposure is less understood, primarily due to the challenges of accurate chemical identification of particles with sizes in the sub-micron range. This study aimed to assess infant oral exposure to both MPs and NPs from these sources. To ensure inclusion of sub-micron particle sizes, the mass based analytical detection method pyrolysis gas chromatography-mass spectrometry (Py-GC-MS) was employed for polymer identification and quantification. Rigorous quality assurance/quality control procedures were developed to minimise sample contamination and account for matrix interferences that may lead to overestimation of MNPs. Different brands (five) and types (single use vs reusable) of breast milk storage bags, and reusable storage/feeding bottles (three) were evaluated. The reusable bottles and bags were sterilised and filled with ethanol:water 50% v/v (milk simulant) for five repeated cycles, while the single use bags were filled as purchased. The simulant was filtered through a 1.0µm filter for MPs and 0.3µm for NPs. Results demonstrated the presence of PP MPs (<0.37–1.96µg/bottle) released from two of the three bottle brands (A and B) after the first sterilisation cycle, with decreased release in the subsequent cycles. PP NPs (0.3 – 1.0µm) were detected only in brand B at an average of 0.49 ± 0.28µg/bottle over the 5 sterilisation cycles. Breast milk storage bags had low detection frequencies of MNPs with 2.6% of the samples evaluated releasing MNPs. A polyethylene (PE) interference signal was identified in all samples. GC-Orbitrap analysis of a precipitate in the simulant determined the presence of erucamide, a slip agent used during plastic manufacturing, although this was not the main source of the PE interference, which still needs to be investigated. Overall, the findings from this study indicate that exposure to PP may be low from baby bottles, but it is suggested that conducting at least two sterilisations before first use will reduce infant exposure to PP.

Multimodal detection and analysis of microplastics in human thrombi from multiple anatomically distinct sites
- Shaowei Guo (E)

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Background: Microplastic (MP) pollution has emerged as a significant environmental concern worldwide. The potential impact of MPs on human health, particularly on the circulatory system, remains understudied. This project aimed to identify and quantify the mass concentrations, polymer types, and physical properties of MPs in human thrombi surgically retrieved from both arterial and venous systems. Furthermore, this study aimed to investigate the potential association between the levels of MPs and disease severity. Methods: Thirty thrombi were collected from patients who underwent thrombectomy procedures due to ischaemic stroke (IS), myocardial infarction (MI), or deep vein thrombosis (DVT). Pyrolysis - gas chromatography mass spectrometry (Py-GC/MS) was employed to identify and quantify the mass concentrations of the MPs. Laser direct infrared (LDIR) spectroscopy and scanning electron microscopy (SEM) were used to analyse the physical properties of the MPs. Demographic and clinical information were also examined. A rigorous quality control system was used to eliminate potential environmental contamination. Results: MPs were detected by Py-GC/MS in 80% (24/30) of the thrombi obtained from patients with IS, MI, or DVT, with median concentrations of 61.75 μg/g, 141.80 μg/g, and 69.62 μg/g, respectively. Among the 10 target types of MP polymers, polyamide 66 (PA66), polyvinyl chloride (PVC), and polyethylene (PE) were identified. Further analyses suggested that higher concentrations of MPs may be associated with greater disease severity (adjusted β=7.72, 95% CI: 2.01-13.43, $p<0.05$). The level of D-dimer in the MP-detected group was significantly higher than that in the MP-undetected group (8.3 ± 1.5 μg/L vs 6.6 ± 0.5 μg/L, $p<0.001$). Additionally, LDIR analysis showed that PE was dominant among the 15 types of identified MPs, accounting for 53.6% of all MPs, with a mean diameter of 35.6 μm. The shapes of the polymers detected using LDIR and SEM were found to be heterogeneous. Conclusion: This study presents both qualitative and quantitative evidence of the presence of MPs, and their mass concentrations, polymer types, and physical properties in thrombotic diseases through the use of multimodal detection methods. Higher concentrations of MPs may be associated with increased disease severity. Future research with a larger sample size is needed to identify the sources of exposure and validate the observed trends in the study.

Plastics related chemicals in continuously archived 24-hour urine samples of the German Environmental Specimen Bank from 1995 to today: time trends, exposure and risk assessment
- Holger Martin Koch

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Background: Certain chemicals used as polymer additives or building blocks are known endocrine disruptors and reprotoxicants, including several phthalate plasticizers (e.g., DEHP, DBP) and Bisphenol A (BPA). Regulatory bans have led to rapid shifts in usage, with substitutes such as DEHTP, DINCH (plasticizers), and BPS, BPF (BPA alternatives) being introduced - some posing risks of regrettable substitution themselves. Material and methods: We analyzed 41 urinary biomarkers of 18 phthalates, 2 substitutes, and the Bisphenols BPA, BPS, and BPF (after enzymatic hydrolysis) in cryo-archived 24h urine samples from the German Environmental Specimen Bank (ESB). Samples span from 1989 (phthalates) and 1995 (Bisphenols) to 2024. For each year investigated, 60 samples (30 males, 30 females, aged 20–29) were analyzed, totaling over 2,000 samples. Analyses used state-of-the-art LC-MS/MS with isotope dilution and rigorous internal and external quality assurance. Results: For most of the regulated (and non-regulated) phthalates as well as BPA, we observed pronounced declines in urinary concentrations, following regulatory interventions rather quickly. E.g. DEHP and DBP levels dropped by over 95% since the mid-1990s. Nonetheless, exposure remains widespread (>99% detection). BPA levels fell from a median of 1.73 μg/L in 2000 to 0.32 μg/L in 2024. In contrast, BPS rose sharply, with detection increasing from 21% in 2000 to 73% in 2024 (median 0.19 μg/L). Similarly, DINCH and DEHTP exposures increased and are ubiquitous now (>99% detection). Conclusion: ESB data demonstrate regulatory success in reducing exposure to certain critical chemicals. However, increasing exposure to substitutes—some with comparable toxicological profiles such as BPS—highlights the need for early and continuous monitoring and risk assessment to enable timely intervention. Current substitution practices often exchange one hazardous compound for another rather than fostering sustainable alternatives. For plastics, compositional changes in PVC and bisphenol-based products are evident, yet overall exposure to plastics and related chemicals does not appear to decline. Our findings suggest that plastic production and use require fundamental reassessment, particularly where rising output correlates with increased exposure.

Human exposure to Tire-Related Chemicals in Europe

- Mercè Garí

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Background: Tire-related chemicals (TRCs) are an emerging class of plastic-associated pollutants generated by the friction between vehicle tires –composed largely of synthetic polymers– and road surfaces. TRCs include additives used as antioxidants, antiozonants, and heat protectants, as well as vulcanization accelerators and their transformation products (TPs), such as 6PPD and its derivative 6PPD-quinone, 1,3-diphenylguanidine (DPG), benzothiazole (BTH), benzotriazoles (BTRs), and amines such as HMMM. The aim of this study was to develop an analytical method suitable for the analysis of TRCs in urine and to assess human exposure to TRCs in two European cohorts from Spain and Poland. Methods: Urine samples were collected from adolescents (age 14-15) from the REPRO_PL cohort in Poland (n=60) and the CIRCULATE citizen science study from Barcelona (Spain, n=72). The samples (1 mL) were incubated with beta-glucuronidase and subsequently liquid-liquid extracted using ethyl acetate and a basic solution. After evaporation and reconsitution using a mixture of methanol and water (1:1), the extracts (200 uL) were analyzed by liquid chromatography coupled to tandem mass spectrometry (LC-MSMS), using a target method for 30 TRCs. Results & Discussion: The method provided good performance regarding recovery (%) and matrix effects (%). In general, recovery percentages were in the range 70-130 %, except in the case of DPA, NO-DPA and NO-PBA, which provided recoveries above or below the aforementioned threshold. Regarding matrix effects, only 4-HDPA had a signal enhancement, with a percentage above 30%. In the Spanish cohort, a total of 14 TRCs were detected in more than 50% of the analyzed samples. The most frequently detected chemicals were BTR, 5-MBTR, DPA, BLE and 4-HDPA (100%) followed by TBA (97%), HMMM and DCA (94%) and DBA (93%). 6PPD-q was detected in 88% of the samples, with a median concentration of 0.032 ng/mL, and DPG was detected in 83%, with a median concentration of 0.026 ng/mL. In the Polish cohort, the chemicals that were most frequently detected were BTR and DCU (100%), 5-MBTR (98%), DPG (97%) and DBA and C-DMU (93%). Unfortunately, 6PPD-q was not detected in this cohort. Further samples will be analyzed and compared with preliminary results. Conclusion: This work provides a first targeted method for multi-analyte quantification of TRCs in urine and demonstrates its applicability for assessing internal exposure in the general population.

Micro and nanoplastics exposure in young athletes playing football on a field with tyre rubber granulates as infill

- Hubert Dirven

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Young athletes (n=34) played a 90 min football match on an indoor football field with crushed olive stone as infill. Following a 14-days washout period the same athletes played a 90 min football match on an indoor field with tyre rubber granulates as infill. In air samples collected during the matches the total mass of air borne particles smaller than PM10 was higher in the hall with the olive stone infill compared to the hall with rubber granulate infill. Scanning Electron Microscopy examination with correlative Raman spectroscopy of collected air samples demonstrated that the olive stone infill released particles of the olive stone granulate and quartz sand, while the rubber infill released tyre rubber particles and quartz particles. However, tyre rubber particles were present in all air samples, no matter of the sampling location, indicating that tyre rubber particles are part of the ubiquitous urban aerosol. Blood samples were collected at three different timepoints (before the match, directly after the match and 18h after the match). The presence of rubber and plastic polymers in blood were analysed by pyrolysis GC-MS, but the sensitivity of the method was too low and the intrasample variation was too high for use as a biomarker for exposure. Immune cell profiling was performed with CyTOF using a panel of immune cell and cytosolic markers. Immediately after the match increases in neutrophils and decreases in dendritic cells were observed in the blood, but this was observed in both halls. Changes in cell populations were most marked in the samples collected 18-hour after the match. A later sampling time point may therefore have captured additional immune effects. Using the Olink target 48 cytokines panel levels of 45 cytokines in plasma samples were studied. Multiple plasma cytokines showed significant changes in concentration after the matches, but no clear differences between the 2 halls were observed. In conclusion, playing football on artificial fields with tyre rubber granulate infill in an indoor hall for 90 minutes is not a major source of exposure to micro- and nanoplastics (MNPs) for the players. No acute immune-related health effects are expected when playing football on artificial turf with rubber granulate as infill. POLYRISK has received funding from the European Union's Horizon 2020 research and innovation programme (grant Agreement No 964766).

Determinants of exposure to micro- and nanoplastics in women of reproductive age
- Amanda Durkin

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Introduction: Despite the widespread use of plastics, human exposure to micro- and nanoplastics (MNPs) is poorly characterized, particularly with respect to determinants of inhalation exposure. We focus on women of reproductive age, as pregnancy and early life represent critical windows of heightened vulnerability to environmental insults. Methods: We conducted an observational study among 105 women aged 18-46 in the Netherlands. Passive household dust samples were collected at baseline and after 3 months. Pyrolysis–gas chromatography–mass spectrometry (Py-GC/MS) was applied to characterize the MNPs in composition and mass. Participants completed an online questionnaire to capture sociodemographic, behavioral, and household determinants of MNP exposure. Spatial maps of potential environmental determinants including urbanicity, traffic intensity, ultrafine particles (UFP), and particulate matter <10 m (PM10) were linked to participants' addresses. Determinants of MNP deposition rate were evaluated using multivariable linear regression. Results: We measured MNP polymer clusters, attributed to the respective quantifiable base polymers and accordingly include copolymers on a proportional basis, including polyethylene terephthalate (C-PET), polystyrene (C-PS), polypropylene (C-PP), polymethyl methacrylate (C-PMMA), polycarbonate (C-PC), polyethylene (C-PE), and polyamide 6 (C-PA6) (listed in order of decreasing abundance). Every sample contained at least one polymer, and 75% of samples contained five or more polymers. The polymer deposition rates ranged from 0.05 µg/m^2/day for C-PC to 27.69 µg/m^2/day for C-PET. Several determinants were related to total MNP deposition rate in household dust, with household size (Geometric mean ratio (GMR) 1.76, 95% CI 1.11–2.79), occupancy density (GMR 0.90, 95% CI 0.80–0.95), and season (winter vs. summer; GMR 1.21, 95% CI 0.86–1.69) emerging as the strongest contributors. Multivariable models explained up to 40% of variance in MNP deposition rates. Discussion: This is one of the first comprehensive investigations of determinants of MNPs to date. Our models explained up to 40% of the variance in MNP concentrations, which is relatively high for exposure studies, although residual variability suggests that additional, unmeasured sources of exposure remain. Ongoing research in this study population will determine whether MNP levels in household dust and related exposure determinants are associated with internal levels of MNPs.

Human exposure to plastic additives through dermal contact with menstrual products
- Lara Cioni (E)

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Menstrual products are essential to ensure menstrual health, which is recognised as a fundamental human right. However, some menstrual products have been shown to contain chemicals of concern for human health. Since menstrual products are used in direct contact with vulvar and vaginal tissues (which have a high capacity for chemical absorption), dermal contact with these products might be a significant exposure route. So far, the information on the plastic additives content in these products has been very limited. Therefore, we aimed to fill this gap by analysing 4 classes of plastic additives - per- and polyfluoroalkyl substances (PFAS), phthalates (PAEs), organophosphate esters (OPEs) and alternative plasticisers (APs) – in menstrual products and assessing the contribution of dermal contact with these products to plastic additives human exposure. A selection of single-use (10 sanitary pads, 8 panty liners, 9 tampons) and reusable (4 reusable sanitary pads, 4 menstrual panties, 6 menstrual cups) products were extracted with hexane:acetone (1:1) for PAEs, OPEs and APs analysis and with methanol for PFAS analysis. PFAS analysis included both target analysis of legacy compounds and suspect screening of novel PFAS that have been detected in other consumer products. The concentrations of plastic additives found in menstrual products were used to calculate the estimated daily intakes (EDIs) through dermal exposure. All menstrual product types had detectable concentrations of PAEs, OPEs and APs, while PFAS were only detected in reusable products. Reusable sanitary pads showed the highest concentrations of PAEs and OPEs, while menstrual underwear showed the highest PFAS concentrations. The highest APs concentrations were observed in sanitary pads and panty liners. The lowest EDIs were observed for PFAS (0.00-0.51 ng/kg bw/day) and were well below EDIs for other routes relevant for PFAS, such as the diet, suggesting that menstrual product use might be a minor contributor to PFAS exposure. On the contrary, the use of menstrual products might be a relevant exposure route for OPEs (0.00-237 ng/kg bw/day), PAEs (0.00-3105 ng/kg bw/day) and APs (0.01-7140 ng/kg bw/day), since EDIs for these compounds were comparable to those for dietary intake or other relevant exposure routes (e.g., dust ingestion, air inhalation). These results highlight the need to investigate the release of these chemicals from menstrual products to the skin to provide more realistic estimates.

Migration of plastic and adhesive-related oligomers (PAROs) from puree pouches: a comparison between food simulants and food samples

- Cheng Tang (E)

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Multilayer plastic is widely used for pre-packed baby food puree pouches due to its convenience and ability to extend shelf life. Studies have shown that plastic- and adhesive-related oligomers (PAROs) can migrate from such packaging; however, infant exposure remains poorly characterised. Moreover, previous studies commonly used food simulants to test and identify migratable PAROs, while identification in pouch-stored food has rarely been conducted. This study screens commercial pre-packed pouches to identify the range of migratable PAROs, confirm their origin, and evaluate the suitability of simulants as substitutes for food in migration studies. A total of 48 pre-packed food pouches were purchased. The food content was emptied and extracted using a modified QuEChERS method. Pouches were rinsed three times, filled with four types of food simulants, and subjected to a migration test at 40 °C for 14 days following EU regulatory recommendations. Post-storage simulants were aliquoted into vials for analysis. To verify that PAROs originated from the pouch material, four types of infant foods (fruit puree, risotto puree, custard, and yoghurt) stored in glass jars, as well as the previously mentioned simulants, were separately filled into unused pouches. Samples were taken before filling, immediately after filling, and after 14 days of storage at 40 °C, then processed as described above. Prepared samples were analysed using liquid chromatography coupled with quadrupole time-of-flight mass spectrometry, and suspect screening was performed. Across the 48 pouch-stored food and simulant samples, 41 PAROs were detected, with an average of 11 PAROs per pouch (maximum 20). Only one brand showed no PARO detection in both food and simulant samples. Most detected PAROs contained structures similar to the soft segment of polyurethane. When food purees and simulants were filled into unused pouches, no PAROs were detected in samples taken before or immediately after filling, but they were present after storage. These findings demonstrate that PAROs detected in pouch-stored food originate from pouch materials and are widely present in these materials. In unused pouches, simulants, custard, and yoghurt showed seven PAROs, while fruit and risotto purees contained an additional seven PAROs. Differences observed between food and simulants highlight the need for further research to determine whether simulants are suitable for future PARO migration and exposure assessments.

Per- and Polyfluoroalkyl Substances in the Human Brain

- Marina Suzuki (S)

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Introduction: Per and polyfluoroalkyl substances (PFAS) are widely used in commercial and consumer products due to their useful properties, such as water and oil repellency, and high thermal stability. PFAS have been detected in different environmental and biological matrices, including human blood and human post-mortem brain tissues. While a few studies have investigated the entry of PFAS into the brain, the number of PFAS examined has been highly limited, and the potential factors influencing their partitioning to and accumulation in the brain have not been thoroughly explored. This study aimed to investigate the presence of PFAS in the human brain tissue and to estimate brain-to-serum PFAS concentration ratios (Cb/Cs) to identify factors that contribute to differences in brain accumulation among various PFAS compounds. Materials and Methods: Matched human brain and serum samples were obtained from 10 individuals. Samples were analysed for a total of 43 PFAS. PFAS measurements were conducted using high-performance liquid chromatography coupled with tandem mass spectrometry. Results: Of the 43 PFAS analysed, 18 were detected in at least one serum or brain sample. Five PFAS - perfluorononanoic acid, perfluorodecanoic acid, perfluorohexanesulfonate (PFHxS), perfluorooctanesulfonate (PFOS), and N-methyl perfluorooctanesulfonamido acetic acid (N-MeFOSAA) - were detected in both serum and blood in all individuals. Two further PFAS were detected in all brain samples, and six further PFAS were detected in all serum samples. PFOS exhibited the highest mean concentration in both brain and serum samples. Cb/Cs ratios, calculated for compounds detected in most samples, ranged from 0.04 for PFHxS to 1.3 for -MeFOSAA and tended to increase with increasing numbers of fluorinated carbon atoms in the molecule. Discussion and Conclusion: Our study demonstrated the presence of a variety of PFAS in the human brain tissue. The large variation in Cb/Cs across different PFAS indicates that these compounds accumulate in the brain to varying degrees. The observed trend of increasing Cb/Cs with increasing number of fluorinated carbons suggests that the lipophilicity of PFAS - largely related to their fluorinated carbon chain length - may play an important role in their partitioning to and accumulation in the human brain. The implications of PFAS accumulation in the brain and its association with specific neurological disorders need to be studied further.

Evaluating microplastic particles as vectors of exposure for plastic additive chemicals using a food web model

- Todd Gouin

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Microplastic particles (MPs) represent potential hazards for humans and wildlife, including as vectors for chemical exposure (e.g. plastic additives and pollutants sorbed from the surrounding environment). The leaching of chemicals from MPs has been identified as a potential exposure pathway but the relative magnitude of this pathway under environmentally relevant conditions remains unclear. Here, we describe a modification of the ACC-HUMANSTEADY bioaccumulation model to include dietary exposure to MPs containing either accumulated chemicals from the surrounding environment or embedded plastic additive chemicals (PACs). Chemical transfer to humans and wildlife is described using two-film resistance concepts assuming spheroidal or cylindrical particles of different sizes. The relative contribution of MPs and environmental media to the estimated daily chemical intake in humans was assessed in various exposure scenarios, for a range of hypothetical chemicals with varying octanol-water and air-water partition coefficients (KOW and KAW, respectively; i.e. 0 10 mg d-1, and the concentration of hydrophobic plastic additive is >5% wt wt-1. The contribution made by MPs as vectors of exposure decreased with increasing particle size and decreasing ingestion rates of MPs. Human health risks were evaluated for four specific PACs to illustrate the application of the model for risk assessment. Risks were negligible when the ingestion rate of MPs was <100 µg d-1. Uncertainties are high regarding the characterization and quantification of ingestion of MPs by humans and wildlife, including particle sizes and polymer composition, as well as on the presence of PACs in MPs. These data gaps need to be addressed if the issue of MPs as vectors of chemical exposure is to be fully understood. The work illustrates that mechanistic models, which account for all major exposure pathways, can be used to identify the importance of different exposure pathways, help prioritize research needs and support decision making.

Atmospheric Microplastics in Urban and Remote Areas: Occurrence, Sources and Seasonality

- Natascha Schmidt (E)

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Microplastics are ubiquitous environmental contaminants that have been detected in all environmental compartments around the world after the term “microplastic” was coined about two decades ago. While early research mainly focused on aquatic environments, atmospheric microplastics (AMPs) are now receiving growing attention due to their potential for long-range atmospheric transport and their implications for human health. AMPs are a component of the air pollution mix humans are exposed to, especially in urban areas, and emerging evidence indicates that micrometer-sized particles (here: PM10 = particulate matter with an equivalent aerodynamic diameter of max. 10 µm) can penetrate into the respiratory system via inhalation, causing inflammation and other adverse health effects. Although critical information on the fate and impact of AMPs in the human body, such as translocation and clearance, is still lacking, it is vital to improve our understanding of their environmental occurrence, temporal trends, and sources to better access exposure risks and develop mitigation measures. Here, we present data from AMP monitoring campaigns in Norway covering urban, rural, and remote locations, including both inter-annual and intra-annual datasets. The data comprises passive (total deposition) and active air samples analyzed using pyrolysis-GC/MS. Where applicable, the source-origin and respective contribution of microplastics to the receptor were examined using the FLEXPART model. Our findings show a clear dominance of tire wear particles (TWP) in atmospheric samples from urban sites, accounting for up to 90% of total AMP, along with distinct seasonal variations. Data from the remote Zeppelin Observatory at Svalbard in the Arctic confirms long-range transport of AMPs, particularly during periods when air masses originate from continental Europe. We will also present preliminary AMP data from PM10 samples collected in Oslo in autumn 2025, coinciding with the seasonal transition from summer to winter tires.

exposure

Understanding spatial and temporal trends of atmospheric microplastics and nanoplastics in laboratories

- Honglin Chen (S)

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Assessing atmospheric microplastics and nanoplastics (MNPs) concentrations in laboratories is crucial for understanding potential background contamination of samples and occupational exposure for laboratory workers. With increasing studies investigating atmospheric MNPs concentrations in various indoor environments, few studies have monitored MNPs in a controlled air-exchange laboratory environment, where samples are processed and analysed. This study compares the spatial and temporal distribution of atmospheric MNPs in a general-use Physical Containment Level 2 (PC2) laboratory with a purposely built plastic-minimised clean laboratory. Deposition samples were collected fortnightly using passive air samplers (14 cm × 20 cm) at 5 locations within the PC2 and clean laboratories. Microplastics (MPs) were separated using 1 µm glass fibre filters and analysed using pyrolysis-gas chromatography-mass spectrometry (Py-GC-MS) to quantify a wide range of polymers. Nanoplastics were assessed using a workflow combining asymmetrical flow field-flow fractionation with multi-angle light scattering for size-based separation, followed by Py-GC-MS and scanning electron microscopy for chemical and morphological analysis. Polyethylene, polypropylene, polyvinyl chloride (PVC), polystyrene, polycarbonate, Nylon 6, and Nylon 6,6 were detected in samples. PVC (3.90 ± 3.85 ng/cm2/week) was commonly detected at all locations, indicating that vinyl flooring (present in both laboratories) could be a primary source of MP release due to abrasion. Total polymer concentrations ranged from 0.29 to 54.3 ng/cm2/week, lower than previously reported indoor concentrations. The PC2 laboratory showed higher MP concentrations than the clean laboratory, suggesting that the combination of positive pressure and continued HEPA-filtered air circulation within the clean laboratory effectively reduces potential background contamination of MPs. Preliminary investigations also indicate that concentrations increased with more frequent laboratory activity in both laboratories, indicating human traffic through the area is a key contributor to atmospheric particles. This study highlights potential emission sources of MNPs within laboratories and the effectiveness of purpose-built clean laboratories in minimising background contamination during MNP analysis. It also provides new knowledge on how large-scale air circulation/purification strategies could reduce the risk of inhalation exposure to MNPs.

Advancing Indigenous-led Microplastic and Nanoplastic Research in Indigenous Communities

- Lynn Jacobs (S)

Lynn Jacobs[1]

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There is growing concern in Indigenous communities about the presence and impacts of plastics and associated chemicals in lands, waters, air, wildlife, and wild foods. Close ties to the land and the consumption of country and traditional foods makes Indigenous Peoples especially vulnerable to plastic pollution at all stages of the plastic lifecycle. Unfortunately, current research has only touched the surface of the potential impacts and risks of plastic pollution to foods, health, and cultures of Indigenous Peoples. Relatively few Indigenous communities have access to information, tools or funding to develop monitoring programs that would be relevant to their specific concerns and exposure pathways. This demonstrates a need for accessible and affordable community-based methods to monitor plastics, steered by Indigenous science, approaches, and priorities. Working with partners in an Indigenous community in Canada we are characterizing the major environmental exposure pathways (e.g., waters, soils, air, wild foods, crops, and medicinal plants) for macroplastics, microplastics and nanoplastics (MNPs) to establish a better understanding of the unique exposure routes. We will develop a toolkit that will be adaptable for other Indigenous communities, providing training in accessible and affordable community-based measurements of plastic pollution. Community control over the assessment and communication of risks is essential to ensure culturally appropriate approaches. Long-term, community-led MNP monitoring programs in Indigenous communities will build a culturally relevant knowledge base for the detection of MNPs as a stepping-stone for solution-building based on Indigenous science and approaches. Shifting the tools, resources, and decision-making to Indigenous communities will also enable more accurate assessments of plastic pollution risks in Indigenous communities, support Indigenous-led or co-led research, and improve the relevance of plastic pollution policy and scientific assessments for Indigenous Peoples and other frontline groups who are too often left out of these processes. Ultimately, this work will uplift the rights, science and engagement of Indigenous Peoples in decision-making about plastic pollution, including in the ongoing negotiations for an international legally binding instrument on plastic pollution. (Note: This research is multidisciplinary and crosses several conference themes including exposure, risk or policy.)

Fabrication of Micro/Nanoplastic Particles and Fibres for In Vitro Alveolar Exposure Studies
- Eric Auyang (E)

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Micro- and nanoplastics (MNPs) are increasingly being detected in indoor and outdoor air, raising concerns about their potential impact on respiratory health. Airborne MNPs vary in chemical composition, shape, and size, with some being small enough to reach the alveoli if inhaled. However, current studies have focused on a limited number of polymer types and morphologies due to restricted commercial availability. To investigate MNP interactions in the alveoli, polyamide 6,6 (PA), polystyrene (PS), and polyethylene terephthalate (PET) MNPs were fabricated via polymer precipitation and electrospinning to produce microplastics (MPs), nanoplastics (NPs), and microplastic fibres (MPFs). MPs and NPs were confirmed to be of respirable size (<4 µm), and MPFs were also respirable based on their diameter (<3 µm), length (>5 µm), and aspect ratio (>3). MNP size distribution was assessed using light microscopy and dynamic light scattering (DLS), while chemical contaminants were analysed via inductively coupled plasma mass spectrometry and thermal desorption/gas chromatography. In vitro studies were conducted using transformed type-1 (TT1) alveolar epithelial cells and differentiated THP-1 macrophages. PA MPs and PA and PS MPFs significantly reduced cellular metabolic activity in THP-1 cells at concentrations as low as 3.12 µg/ml after 24 hours. None of the other MNP types elicited any effect, and no effect was observed in TT1 cells. No membrane damage or IL-6, IL-10, or TNF-α release was detected from either cell type. Scanning electron microscopy was used to observe MNP interactions with THP-1 cells after 24 hours. While neither cell type showed a biological effect after NP exposure at any concentration, dosimetry analysis using both in vitro and in silico methods revealed poor NP deposition onto the cell monolayer. When cellular metabolic activity was corrected to the dose delivered rather than the dose administered, apparent NP toxicity increased. In conclusion, MNP toxicity in THP-1 macrophages is dependent on polymer type, shape, and size. TT1 epithelial cells showed no significant response after MNP exposure. These findings also highlight that submerged in vitro models may underestimate NP toxicity due to limited particle deposition, underscoring the importance of dose correction in toxicity assessments.

The impacts of microplastics and indoor microplastic-aerosol mixtures on THP1 macrophage immunometabolism
- Stephanie Wright (E)

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Introduction: Microplastic has recently been observed in ambient and indoor air, including in size ranges considered respirable, i.e., able to reach the deep lung, where macrophages are a key line of defence. However, microplastic exists in a wider mix of ambient particulate matter (PM), which could lead to antagonistic, additive or synergistic effects, and people spend most of their time in their homes. This study aims to explore the immunometabolic effects of microplastics in the context of known indoor pollutants, modelled on the home environment, in a macrophage model and elucidate the underlying pathways involved. Methods: Differentiated THP1 cells (M0) were exposed to a panel of aerosols, including wood burning, cooking, diesel, an indoor PM dust standard, and in-house microplastic particles (1-2 µm, polyamide-6,6 [PA-6,6], polyethylene terephthalate [PET], and polystyrene [PS]) both alone and blended to different ratios, at concentrations ranging from 0 to 20 µg/mL for 48 h. Cell viability (metabolic activity) was assessed using MTT assays, cytotoxicity was quantified using lactase dehydrogenase assays, cytokines (IL-8, GMCSF and MCP1) were analysed using ELISAs, and the extra and intracellular metabolomic changes via nuclear-magnetic-resonance and ultra-performance-liquid-chromatography coupled to mass spectrometry. Results: PA-6,6 and wood burning were most toxic on their own, significantly reducing metabolic activity by >25% and >40% and with no observed effect concentrations of 10 µg/mL and 5 µg/mL, respectively. Cytotoxicity mirrored this response. For aerosol:microplastic blends, microplastic (1:2:3 PA-6,6:PS:PET) at a 0:1 ratio and woodburning at 1:0 and 9:1 ratios reduced metabolic activity. Preliminary cytokine analysis suggests that MNP exposure increases VEGF secretion independently from the aerosol within the mixture and that there is a greater release of IL-8 following co-exposure to microplastics +wood burning and +PM, compared to diesel- or cooking-microplastic mixtures or the microplastic mix alone. Conclusions: Considering the observed endpoints, PA-6,6 and microplastic mixtures were found to be more toxic than some key PM source components (cooking aerosol, diesel, indoor PM), but less toxic than the wood burning aerosol, whilst mechanistic evaluation is ongoing.

Mechanistic studies of inhaled microplastics in the human lung in vitro
- Julia Laskowska (S)

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Background: Airborne microplastic (MP) particles are increasingly recognised as a component of ambient particulate matter (PM). However, the impact of MP inhalation on the respiratory system remains poorly understood, specifically how deposition of inhaled MP interacts with the respiratory epithelium of the gas-exchanging units (alveoli) of the lung. Objectives: This study aims to improve understanding of the mode of action of MP respiratory toxicity by i) fabricating and fully characterising environmentally relevant MPs - polyamide (PA) and polyethylene terephthalate (PET), and ii) determining their molecular biological impact on human alveolar cells as primary targets of inhalable particles. It is hypothesised that the bioreactivity of MPs will depend on their physicochemical properties and target cell type. Methods: PA and PET reflecting environmental MPs were fabricated using a precipitation technique and characterised by size, shape, surface charge and chemical composition. Three human alveolar cell lines (TT-1 epithelial type 1-like cells, HAEL-2, epithelial type 2-like cells, THP-1 macrophages) were exposed in vitro to increasing concentrations of PA and PET MP, to simulate interactions following deposition at the alveolar gas-liquid interface. The cellular responses were assessed through viability (MTT) and cytotoxicity (LDH) assays, alongside cytokine mediator release (ELISA) and cellular profiling via FACS analysis. Results: The fabricated MPs exhibited properties closely resembling the environmental samples. Both MPs had a mean diameter of 2µm and displayed contrasting morphology; PA was jagged and angular, PET was spherical. PA had an impact on ell viability of two cell lines, with a higher reduction in THP-1 and TT-1 cells ($p<0.002$, $p<0.0013$) in comparison to PET ($p<0.0057$, $p<0.0459$). PA and PET induced comparable increased release of IL-6 and IL-8 by TT1 (124-fold increase and 20-fold increase respectively). Interestingly, the marked increase in proinflammatory and apoptotic markers in all cell types exposed to PA was not observed on exposure to PET. Ongoing lipidomics and electron microscopic analysis is also underway. Conclusion: This study suggests that the bioreactivity of inhaled PMs will critically depend on their physicochemistry and target cell type. Use of synthetic MPs that represent environmental MPs to provide insight into the poorly understood cell response will identify mechanisms and inform translational in vivo studies.

Nanoplastics activate innate immunity in microglia and exacerbate α-synuclein–induced neurotoxicity
- Eduardo Albornoz (E)

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The increasing accumulation of plastic waste in the environment has led to the emergence of micro- and nanoplastics (NPs) as novel contaminants with potential health impacts. While their effects on peripheral tissues are increasingly recognised, the consequences of NP exposure on the human brain and its resident immune cells remain poorly understood. Here, we investigated the neuroimmune response to environmentally relevant nanoplastics using human induced pluripotent stem cell (hiPSC)-derived brain organoids containing microglia, as well as human monocyte-derived microglia-like cells (MDMi). We examined the effects of a panel of polystyrene (PS)-based NPs, fluorescently labelled or unlabelled, with sizes ranging from 25 to 50 nm, across a range of doses and time points. Exposure to all NP types induced a dose- and time-dependent activation of microglia, characterised by upregulation of proinflammatory mediators and morphological changes indicative of reactive states. Functionalised particles (COOH-PS and NH_2-PS) elicited stronger activation than non-functionalised PS, suggesting that surface chemistry modulates their immunogenicity. Notably, the presence of α-synuclein aggregates, key pathological drivers in Parkinson's disease, potentiated NP-induced microglial activation, amplifying inflammasome-related and cytokine responses. In human midbrain organoids containing microglia, combined exposure to NPs and α-synuclein aggregates resulted in pronounced microglial activation and dopaminergic neuronal loss, recapitulating early neurodegenerative features. These findings identify nanoplastics as novel environmental neurotoxicants capable of eliciting innate immune activation in human microglia, particularly under conditions of protein aggregation stress. Our data provide mechanistic insight into how chronic exposure to nanoscale plastic contaminants may synergise with pathogenic proteins to accelerate neurodegenerative processes. Future studies will assess the neurotoxicity of environmentally derived nanoplastics in vitro and in vivo to better evaluate the neurological risks of plastic pollution and develop strategies to mitigate its long-term impact on brain health.

Exploring the interaction of carboxylated polystyrene nanoplastics with hepatic cell lines and human precision-cut liver slices

- Namrata Pandey (S)

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Microplastics (<5 mm, MP) and nanoplastics (<1µm, NP), produced in the environment, can enter the human body via ingestion, inhalation or dermal contact. Several studies have reported MP/NP in human tissue, raising concerns about potential adverse health outcomes. Due to its unique anatomical structure, the liver faces a high risk of MP/NP exposure through the digestive and circulatory systems. Presently, liver diseases account for 4% of global mortality. The risk of Metabolic Dysfunction-associated Steatotic Liver Disease (MASLD) in adolescents represents one of the most significant global health threats. Existing research on NP toxicity is variable and lacks sufficient understanding of the liver-associated pathophysiology. To understand the impact of NP on the liver, we determined the uptake and effects of commercially available carboxylate-modified 20 nm polystyrene nanoparticles (PS NPs) in three hepatic models: human carcinoma hepatocytes (HepG2), immortalised human hepatocytes (IHH), and human precision-cut liver slices (hPCLS). We visualised and quantified PS NPs uptake using confocal microscopy and flow cytometry and analysed cytotoxicity post-exposure. Further, we examined the subtle physiological effects of PS NPs on the redox state and mitochondrial respiration in HepG2 cells. Exposure experiments show a model and dose-dependent uptake of PS NPs after 24 and 48 hrs of exposure in all three hepatic models. 63.0 ± 31.5% IHH cells showed PS NPs uptake at a concentration of 0.1 µg/mL, which is lower than the measured plastic concentration in human blood (1.8 -4.7 µg/mL). Cell viability of IHH cells decreased from 95.2 ± 2% in the control group to 9.7 ± 7.1% at 100 µg/mL after 48 hours of exposure. Early signs of cell injury were observed with high levels of AST enzyme in the media of IHH and hPCLS at high PS NPs concentrations. Additionally, HepG2 cells showed no changes in cell viability, redox state, or mitochondrial respiratory parameters after exposure to PS NPs. In conclusion, the study demonstrates that PS NPs can readily accumulate in hepatocytes, cause cell damage and a decrease in viability. The effect of PS NPs is model-dependent, highlighting the need for physiologically relevant toxicity models to study the underlying mechanisms of NP cytotoxicity. These findings emphasise the urgent need to investigate the health effects of NP pollution on human health, utilising environmentally relevant plastic particles and humanised toxicity models.

Cytotoxicity of Polystyrene Nanoplastics: Role of Ageing-Driven Oxidation and Protein Corona Formation

- Emine Merve Canga (S)

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Nanoplastics (NPs) are emerging contaminants that can enter the human body by dietary exposure. Beyond ingestion of pristine NPs, humans are also exposed to their aged forms. Among various ageing mechanisms, ultraviolet (UV) radiation is a key driver of plastic degradation, leading to photo-oxidation through free radical formation. Our study aimed to elucidate the cytotoxicity and physicochemical behaviour of pristine and UV-aged 50 nm PS NPs (UV-PS) and their interactions with casein. PS NPs were subjected to 36 W UV-C light for 10 days (dry state) and subsequently incubated with casein (500 µg/mL in pure water; 1:1 v/v). NPs were washed and collected by centrifugation. Scanning electron microscopy (SEM) confirmed protein corona formation on both pristine and UV-PS, with altered aggregation states. Dynamic light scattering (DLS) revealed pronounced size increases and heterogeneity after UV ageing and casein interaction: pristine PS was monodisperse (50 nm), PS+Cn slightly clustered (~212 nm), UV-PS aggregated (~410 nm), , and UV-PS+Cn formed the largest assemblies with highest polydispersity (~712 nm). Optical photothermal infrared (O-PTIR) spectroscopy showed that pristine PS lacked carbonyl absorption (1715–1740 cm ^{1}), whereas UV-PS exhibited clear carbonyl peaks indicative of photo-oxidation. Both PS+Cn and UV-PS+Cn displayed strong protein bands, with enhanced amide intensities for UV-PS+Cn, consistent with a thicker corona formed by UV-induced polar groups. Cytotoxicity was evaluated in Caco-2 cells after 48 h exposure with metabolic activity (MTT assay), lactate dehydrogenase (LDH) and reactive oxygen species (ROS) assays. While LDH and ROS showed no significant membrane damage or oxidative stress, all PS samples significantly reduced metabolic activity compared with controls. Among particle types, UV-aged PS forms slightly mitigated this effect, and UV-PS+Cn induced the greatest loss, differing significantly from pristine PS. This enhanced cytotoxicity might attributed to a synergistic effect of UV-induced oxidation and dense casein adsorption, increasing particle adhesion and cellular uptake. In conclusion, UV-induced oxidation altered PS surface chemistry and amplified biological reactivity, emphasising the role of ageing and biomolecular interactions in nanoplastic toxicity and potential human health risks.

Keeping the MOMENTUM going: highlights of 5 years of microplastics and health research in the Netherlands

- Juliette Legler

Juliette Legler on behalf of the MOMENTUM consortium

Research on micro- and nanoplastics (MNPs) is of high priority in The Netherlands and around the world. MNPs are increasingly found in our environment and in our bodies, however, we still know little about the potential health risks of MNPs. This lack of knowledge forms an important barrier to developing and implementing solutions to minimize the potential health impact of MNPs. Since 2021, the Netherlands Organisation for Health Research and Development (ZonMw) has funded a series of research projects called the Microplastics and Human Health consortium (MOMENTUM; www.momentummicroplastics.nl). The overall aim of MOMENTUM is to assess the human health risks of MNPs. In the past 5 years, MOMENTUM has generated standardized MNPs and approaches to studying the health impacts of MNPs, as well as a wealth of data on the exposure and effects of MNPs in humans. The outcome of this ongoing work is an integrated risk assessment of MNPs, which covers chemical, particle, and microbiological components. In addition, solution routes and policy options for risk management of MNPs have been developed, including strategies for setting human and environmental quality risk limits. In the MOMENTUM projects, researchers from universities, academic hospitals, and research organisations work together with private sector organisations and key stakeholders within an interdisciplinary, intersectoral collaboration. This unique collaboration is being formalized in the MOMENTUM collaborative network, which aims to link with similar international initiatives. In this presentation, I will present highlights of 5 years of research, as well as our goals for the coming 4 years. This work is part of the MOMENTUM and MOMENTUM2.0 projects. The MOMENTUM project was made possible by ZonMw Programme Microplastics and Health, and Health-Holland, Top Sector Life Sciences & Health (project number 458001101). The MOMENTUM2.0 is funded by ZonMw Programme Microplastics and Health (project number 4580012310002).

Systemic inflammation and cardiometabolic dysfunction induced by nylon and polyester micro- and nanoplastic exposure

- Patrick Lelliott (E)

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Micro- and nanoplastic (MNP) pollution is pervasive and projected to rise with increasing global plastic production. Clinical studies link MNP exposure to elevated risks of stroke, myocardial infarction, and all-cause mortality. However, mechanistic understanding of MNP toxicity remains limited and heavily reliant on polystyrene bead models, which poorly represent human exposure. This study investigated the toxicity of weathered MNPs, focusing on systemic inflammation and cardiometabolic dysfunction. We developed the Accelerated Plastic Aging in Suspension (APAS) system, which aims to simulate plastic degradation that occurs in natural waterbodies and oceans, to generate heterogenous MNPs from nylon and polyester (polyethylene terephthalate, PET). Male and female C57BL/6J mice were administered 1 mg/kg/day MNPs via drinking water for 9 weeks. Metabolic and immune profiles were monitored during exposure including plasma lipidomic profiles, EchoMRI, and high-dimensional flow cytometry of immune cells. In vitro studies of human and mouse immune responses to MNPs were also conducted. MNP exposure increased levels of plasma inflammatory cytokines, including TNF-α and IFN-γ, and caused pronounced neutrophilia. Increased necrosis and apoptosis were observed across different major tissues. Lipidomics and EchoMRI measurements indicated substantial shifts in triglyceride metabolism and body composition. MNPs activated both human and mouse immune cells in vitro, causing L-selectin shedding, degranulation, ROS release, and neutrophil extracellular trap (NET) formation. In vitro and in vivo responses were highly dependent on polymer type, with distinct responses to nylon and polyester exposure. Overall, nylon and polyester MNPs generated via simulated weathering drive significant inflammation and metabolic disruptions in mice. The polymer specific nature of effects highlights the need for polymer-specific toxicological profiling and underscores issues with generalisation of polystyrene bead-based models to real-world exposure. This work provides critical mechanistic insights into MNP-induced cardiometabolic dysfunction and highlights the need for further research to better inform public health and regulatory initiatives targeting exposure to plastic pollution.

Assessing the permeation of surface-modified nanoplastics (NPs) across in vitro human gut-blood and blood-brain barrier models

- Yufei Pan (S)

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Micro and nanoplastics (MNPs) are an increasing concern for human health due to our constant exposure to plastic products and environmental plastics. Although MNPs have been reported in various human organs, the mechanisms underlying their permeation across critical biological barriers remain unclear and understanding this translocation is essential to understand realistic occurrence in human matrices. Permeation is complex and influenced by factors e.g. particle size, charge, surface chemistry and cell types. This study investigates the behaviour and fate of nano-sized plastics (NPs) using a human cell model that represents 2 key human biological barriers – the gut-blood barrier (GBB) and the blood-brain barrier (BBB) – to deepen understanding of the potential health risks associated with NPs. These barriers are modelled using simple in vitro systems with human brain endothelial hCMEC/D3 cells and intestinal epithelial Caco-2 cells, seeded into collagen-coated apical chambers of Transwell plates. Fluorescent 25 nm polystyrene (PS) particles with different surface modifications: amine-functionalised (NH2-PS), carboxylate-functionalised (COOH-PS) and non-functionalised (n-PS) were first characterised using transmission electron microscope and dynamic light scattering. Cytotoxicity, uptake and permeation through cell monolayers were then investigated. Results demonstrated that NH2-PS reduced cell viability at lower concentrations compared to the other NPs in both cell lines, although this effect was only observed at relatively high concentrations (≥500 µg/mL). Caco-2 cells were more tolerant to all 3 types of NPs than hCMEC/D3 cells. Confocal microscopy revealed that cellular uptake of n-PS was significantly higher than that of surface-modified PS in both cell lines. While different variables of the model are still under investigation, preliminary Transwell experiments demonstrated that all 3 types of PS permeated through a BBB monolayer after 1h, with NH2-PS exhibiting the highest rate of permeation (~1.8% of particle dosage). No change was observed in trans-endothelial electrical resistance (TEER) before and after the experiments, confirming that the barrier integrity was not compromised. Future experiments will focus on evaluating the effects of other NPs characteristics, including shape and surface degradation, on permeation. These in vitro studies represent an initial step toward understanding the potential health risks of environmentally relevant NPs.

Investigating isolated and combined co-exposure of micro(nano)plastics and air pollution particulate matter using in vitro models of the alveolar barrier

- Kirsty Meldrum (E)

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The toxicity of realistic human micro- and nano-plastic (MNP) exposures, especially combined exposure with other environmental particles (e.g. in/outdoor air pollution particulate matter (PM)) is currently unknown. Therefore, we aimed to use environmentally relevant MNPs, and PM to elucidate health impacts of realistic MNP exposures. Using well characterised physiologically relevant in vitro models of the alveolar region (type I (hAELVi) and II (NCI-H441) epithelial cells and differentiated macrophages (THP-1)) the implications of sequential and combined multi-pollutant exposures (MNP and PM) were investigated. Toxicological and immunological responses were determined 24hr post aerosol exposure (VITROCELL® Cloud12) to respirable polypropylene (PP) (200, 300 and 500ng/cm2), polyamide (PA) (2352ng/cm2), polyethylene terephthalate (PET) (3304ng/cm2), and polystyrene (PS) (2515ng/cm2), and standard reference materials of indoor (SRM2583) and urban dust (SRM1649b) (400, 780, and 1000ng/cm2) PM in isolation and combination. No exposures altered viability or barrier integrity ($p>0.05$). Dose dependant increases above baseline ($p>0.05$) in TNF-α, and IL-8 after exposure to PP, and IL-6 after exposure to PET and PS alone were identified. The addition of indoor PM (780ng/cm2) to PP (500ng/cm2) either before, after or in combination increased ($p>0.05$) the concentration of IL-8 and IL-6 above baseline when compared to PM (780ng/cm2) and PP alone (500ng/cm2). However, exposure to PP either before or after urban dust (780ng/cm2) decreased concentrations of IL-8 and IL-6 when compared to PP and PM alone, but not after combination exposures above baseline. Co-exposure of PA (2352ng/cm2), PET (3304ng/cm2), or PS (2515ng/cm2), with indoor PM and urban dust (780ng/cm2) increased IL-6 and IL-8 release compared to respective single pollutant exposures, though significance was only reached when PS was co-exposed with indoor PM or urban dust ($p<0.05$). This work highlights the importance of using "real-life" MNP samples as well as combining with additional relevant PM mirroring realistic human exposures. Interestingly, the order of MNP/PM exposure influenced the biological responses, with the most biologically significant transpiring from combinations compared to sequential exposures. Research is ongoing to determine a ranking approach for the various MNPs in realistic exposure scenarios, linked to pre-existing Adverse Outcome Pathways, to predict potential human health hazards.

toxicology

Novel Near-Infrared Imaging for Toxicological Studies of Microplastics and Nanoplastics
- Lanpeng Yang (E)

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Plastics degrade into micro/nanoplastics (MNPs), leading to unpredictable bioaccumulation and adverse effects. However, we have very little capability to actually track these MNPs in organism. This bottleneck was largely due to the lack of reliable technique to visualize the MNPs. To address this, we have developed a near-infrared (NIR) imaging technology that enables tracking of the localization and dynamic effects of MNPs within organisms. This technique operates in the NIR wavelength range, which avoids interference from biological autofluorescence and overcomes the long-standing limitation of high background noise in in vivo detection of MPs. Furthermore, NIR imaging can detect various biomarker changes induced by MNPs. Notably, this technology allows for non-invasive in vivo detection and continuous monitoring without the need to sacrifice the organisms. We have successfully applied this method to track the localization and function of MNPs in cells, organs, and individuals (zebrafish), and it can also be extended to mammalian models. Here are several concise highlights: (1) We developed the NIR-II based NPs and MPs and visualize the movements of these particles once they are accumulated in the fish. Based on these first kinetic data, we then for the first time conducted the modeling of the transport and accumulation of MNPs in the fish body. (2) We used NIR imaging to capture the transient responses (biochemicals) to MNPs challenges. For the first time, we also coupled the bioaccumulation (toxicokinetics) and toxicity (toxicodynamics) of MNPs. (3) We used NIR imaging to detect the subtle effects of MNPs on fish red blood cells at environmentally relevant concentrations, established the dose-response relationship, and revealed that the toxicity threshold of MNPs may be lower than certain reported concentrations measured in human blood. Over all, we have obtained high-quality data on the bioaccumulation and toxicity of MNPs using this approach, and revealed distinct toxicokinetics-toxicodynamics processes of MNPs. We believe that these findings will provide important understanding to assess the environment risk of different MNPs. Publications: Lanpeng Yang., et. al. ACS NANO, 2023, 17(19), 19410−19420; Environmental Science & Technology, 2024, 58(37), 16269−16281; Journal of Hazardous Materials, 2025, 494, 138548; Environmental Chemistry and Ecotoxicology, 2025, In Press; Environmental Science & Technology Letters, 2025, accepted.

Pathway-Based Genetic Score for Xenobiotic Metabolism: An Indicator of Host Vulnerability to Plastics-Induced Neurological Conditions

- Ahmed Elagali (E)

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Prenatal exposure to environmental pollutants, including plastic-associated chemicals such as phthalates, has been linked to neurodevelopmental conditions like autism. We previously showed that gene–environment (G×E) interactions involving oxidative stress and inflammation are relevant to autism. Here, we extend this investigation to xenobiotic metabolism to illustrate how converging G×E mechanisms underlie autism causation, reflecting complex interactions between genetic and environmental factors early in life. This population-based cohort study used data from the Barwon Infant Study (Australia) to examine whether genetically determined variation in xenobiotic metabolism modifies autism risk following prenatal exposure to environmental toxicants. A pathway-based genetic function score for xenobiotic metabolism (gPFS) was developed by integrating expression-associated polymorphisms in cytochrome P450 genes. Associations between gPFS quintiles and doctor-verified autism diagnoses by age 11.5 years were assessed using logistic regression, adjusting for maternal and child covariates. G×E analyses tested modification by prenatal exposure to phthalates (DEHP, BBzP), nitrogen dioxide (NO_2), fine particulate matter ($PM_{2.5}$), and maternal tobacco smoke, individually and in combination. Among 850 children with genotype and exposure data, those in the highest gPFS quintile (≥80th percentile)—indicating reduced xenobiotic metabolism—had increased odds of autism [AOR=2.15 (1.08–4.27)] and co-occurring autism and ADHD [AOR=2.48 (1.12–5.49)] compared with lower quintiles. This genetic risk was strongly modified by prenatal exposures: associations were negligible at low exposure levels but greatly amplified in highly exposed groups. The odds of autism were markedly elevated for children in the top gPFS quintile with high prenatal tobacco exposure [AOR=10.53 (2.63–42.16)] and for combined exposure to phthalates, NO_2, and tobacco smoke [AOR=16.90 (3.51–81.29)]. Significant interactions were also observed for DEHP, BBzP, and NO_2. These findings identify impaired xenobiotic metabolism as a key genetic vulnerability to environmental toxicants during pregnancy. Children with reduced detoxification capacity are at higher autism risk when exposed to pollutants such as phthalates and tobacco smoke. Pathway-based genetic scores may aid early-life risk stratification and guide preventive strategies focused on reducing maternal exposure to modifiable pollutants during pregnancy.

Kynurenine metabolism in pregnancy: a central pathway linking prenatal chemical exposures to autism

- Katherine Drummond (E)

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Despite the increasing prevalence of neurodevelopmental conditions including autism spectrum disorder (autism) and growing evidence of prenatal chemical exposures impacting neurodevelopment, the role of maternal metabolism in mediating these effects remains poorly understood. This observational study examined associations between prenatal chemical exposures and autism diagnoses and characteristics, in the prospective Barwon Infant Study birth cohort (n = 1,074 infants) using multivariable regression models, weighted quantile sum regression, and bayesian kernel machine regression modelling. Maternal exposure to 45 chemicals was quantified using biospecimens and self-reported questionnaires, including plastic-associated chemicals (phthalates and bisphenols), pharmaceuticals, and nutrients. The overall chemical mixture during pregnancy (per SD change) was positively associated with autism diagnosis in the offspring (adjusted odds ratio, aOR 2.2 [1.3–3.7], p = 0.002) and autism-related characteristics (p<0.001). In category-specific chemical mixture models, chemical effects on autism included high-molecular-weight phthalates (p = 0.001) and pharmaceuticals (p = 0.001). Analysis of maternal urine metabolomics at 36 weeks' gestation identified kynurenine pathway metabolism as a mediator, with an elevated quinolinic acid to picolinic acid ratio (QA:PA) explaining 17% of the association between the overall maternal chemical mixture and autism diagnosis in children. QA:PA ratios during pregnancy also mediated the associations of plastic-associated phthalate and phenol mixtures with autism. Child umbilical cord-blood DNA methylation patterns suggest an epigenetic mechanism through which maternal QA:PA imbalance may elevate subsequent autism risk (p = 0.048). Collectively, these findings indicate that kynurenine-pathway dysregulation is a key metabolic mechanism linking multiple prenatal chemical exposures to neurodevelopmental outcomes and point to potential targets for early intervention.

Associations Between Maternal Phthalate Mixtures and the Gut Microbiome during Late Gestation
- Thomas Boissiere-O'Neill (S)

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Introduction: Exposure to phthalates during pregnancy may alter the maternal gut microbiome, with potential downstream effects on the offspring's metabolic and immune health. We investigated associations between prenatal phthalate mixture levels and gut microbial diversity, composition, and predicted functional capacity in pregnant women. Methods: At 36 weeks' gestation, urine and stool samples were collected from 271 pregnant women in the Barwon Infant Study (Geelong, Australia). Nine urinary phthalate metabolites were measured. After 16s rRNA sequencing, taxonomic assignment of amplicon sequence variants (ASVs) was performed using Mothur against the SILVA v123 Nr99, and ASVs were agglomerated to the genus level to yield genus-level OTU counts. We assessed microbial diversity with alpha and beta diversity metrics. Differential abundance analysis was performed using a multi-pollutant limma-voom model to evaluate overall associations between phthalate mixtures and OTU abundance. To complement this approach, quantile G-computation was used to estimate the joint effect of increasing all phthalate metabolites simultaneously. We performed an exploratory functional prediction of the gut microbiome using Picrust2. Results: There was no evidence of association between maternal phthalate mixture and overall microbial alpha or beta diversity. Sellimonas, Dielma, Ruminococcaceae UCG-011 and UCG-009, Holdemania, Adlercreutzia, Coprococcus 1, Blautia, Prevotella, Bilophila, Lactonifractor, Pseudocitrobacter, Hungatella, and Anaerostipes, showed differential abundance in the multi-pollutant model (false discovery rate $q < 0.10$). Coprococcus 1 remained inversely associated with the overall phthalate mixture in quantile g-computation ($\log_2FC = -0.52$, $q = 0.07$). Predicted functional pathways affected included amino acid biosynthesis, carbohydrate metabolism, nucleotide metabolism, vitamin synthesis, and lipid and isoprenoid biosynthesis. Conclusion: Maternal urinary phthalate metabolite mixtures were not associated with overall microbial diversity but were associated with distinct taxonomic and predicted metabolic alterations in the maternal gut microbiome in this cross-sectional investigation at 36 weeks' gestation. This study suggests that phthalates may influence the maternal gut microbiome taxonomy during pregnancy, with potential implications for maternal and offspring health. Further research is warranted to clarify the clinical relevance of these changes.

Prenatal Plastic-Associated Chemical Exposure and Child Neurodevelopment: Insights from the Norwegian Mother, Father and Child Cohort Study (MoBa)
- Gro Dehli Andersen

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Plastic-associated chemicals are increasingly recognized as a concern for child health, potentially affecting brain development in utero and contributing to neurodevelopmental differences and variations in cognitive function in children. As part of the NeuroTox study, prenatal exposure to widespread plastic-associated chemicals was examined in relation to child neurodevelopment among 3,500 mother–child pairs in the population-based Norwegian Mother, Father and Child Cohort Study (MoBa). Maternal phthalates and organophosphate esters (OPEs) were measured in mid-pregnancy urine samples, and per- and polyfluoroalkyl substances (PFAS) were measured in mid-pregnancy blood samples. Associations between maternal chemical levels, their mixtures, and neurodevelopmental outcomes, specifically Attention-Deficit/Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), and cognitive function, were assessed using a range of statistical models, including multivariable-adjusted quartile/quintile logistic regression, restricted cubic splines, and quantile-based g-computation. Models were adjusted for potential confounders, including maternal age, education, parity, smoking, seafood intake, and child sex. Summarized results indicate that higher maternal concentrations of phthalates and PFAS (including perfluorooctanoic acid [PFOA] and perfluorooctane-sulfonic acid [PFOS]) were associated with lower cognitive performance and a greater likelihood of ADHD and/or ASD diagnoses. Elevated OPEs and phthalates were also linked to ADHD-related outcomes. Notably, a non-linear dose–response relationship was observed for PFOA, with both low and high exposure levels associated with less favorable neurodevelopmental outcomes. Several factors, including maternal education and child sex, appeared to modify some associations. Overall, these findings suggest that even population-level exposure to plastic-associated chemicals during pregnancy may influence child brain development. Building on this work, the ongoing MoBa-PlastChem study aims to deepen understanding by assessing a broader spectrum of plastic-associated chemicals and their mixtures, examining neurodevelopmental outcomes and trait trajectories across childhood and adolescence, and exploring potential genetic and endocrine pathways underlying these associations.

Plastic related chemicals and neuropsychomotor development and mental health during childhood
- Kinga Polanska

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Background: Exposures to phthalates, non-phthalate plasticizers and bisphenols may play a role in the child psychomotor and cognitive development as well as mental health, with sex-specific effects, although the results of existing studies are not consistent. In this study we aim to evaluate the associations between childhood exposures to these compounds and neurodevelopmental and behavioural outcomes in the REPRO_PL birth cohort from Poland. Methods: Urine samples (n=400) were collected at the time of children's neurodevelopmental assessment (age 7 years). Online-SPE-LC-MS/MS was used for the determination of BPA and 21 phthalate metabolites. The bisphenol replacement alternatives BPF and BPS, and three metabolites each of the plasticizer alternatives DEHTP and DINCH were analysed in a smaller subset (n=150). Child's neurodevelopment was assessed by the Strengths and Difficulties Questionnaire (SDQ) and the Intelligence and Development Scales (IDS). Multivariate regression models accounting for sex-specific effects were applied, including the use of stratification and interactive approaches. Mixture models adjusted for chemical groups were also applied. Results: BPA, BPF and ΣDEHTP were found to be positively associated with several SDQ scores in boys, including emotional symptoms and conduct problems, as well as the pro-social behaviour. Among girls, the compounds which were associated with poorer behavioural scores were ΣDiBP (total difficulties, emotional problems, hyperactivity/inattention, externalizing behaviour) and ΣDiDP (hyperactivity/inattention). For IDS, higher exposures to BPF were associated to lower scores in fluid IQ and cognition whereas higher exposures to ΣDEHP to lower scores in crystalized IQ and language scores in boys. A negative association between ΣDiNP and Fluid IQ and cognition, and ΣDiDP and motor scores in girls was found. Conclusions: This study indicates that children's exposure not only to the classical phthalates and BPA, but also several of their replacements, such as BPF and DEHTP, might be associated with adverse effects on behavioural and cognitive development of school age children, with divergent sex-specific effects.

Environmental health research: composite chemical exposures and building causal inference by understanding molecular pathways and genetic susceptibility
- Anne-Louise Ponsonby

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Prenatal plastic chemical exposure to bisphenols, phthalates, pesticides and PFAS, a myriad of other chemicals and plastic polymers is of great concern. It has been recommended that chemicals health effects should also be investigated a consideration of composite effects such as the additive effect of multiple chemicals, particularly if they share a common biological mechanism of action such as pro-inflammatory effects. Further, such a consideration of composite plastic chemical effects extends further to multiple other agents also operating through pathways shared with plastic chemical effects such as the pro-inflammatory consequences of diet, other chemicals including air pollution and pharmaceuticals. Even when we account for these exposure classification issues in 'exposome' research', other problems also need to be solved to provide the high level of causal evidence required for improved public health policy and practice.

Molecular epidemiology provides the opportunity to strengthen environmental health research by providing information on the biological by providing information on the biological mechanisms underlying exposure-disease associations with further considerations of genetic influences, including genetic chemical vulnerability. The advent of machine learning now allows deep integration of multiple 'omic layers (e.g. epigenetics, metabolomics in living human), allowing us to utilise system biology approaches to understanding disease cause. By employing multiple different studies and approaches we can build up a triangulation of evidence, beyond replication alone, to allow stronger casual inference. In this session, we provide examples of these approaches applied to better understanding the potential adverse effects of prenatal plastic chemical exposure on autism. Autism has multifactorial causation with multiple environmental and genetic factors operating through shared molecular pathways to cause disease. Future work on the causation of neurodevelopmental disorders such as autism is likely to benefit from examining chemical mixtures operating in pregnancy and both environmental and genetic factors in the context of shared biological mechanisms.

The influence of prenatal exposure to 'plastic chemicals' on maternal and child health, brain structure, neurodevelopmental outcomes, and the infant epigenome: Findings from APrON Neurotox
- Deborah Dewey

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An overview of the research conducted by Alberta Pregnancy Outcomes and Nutrition (APrON) Neurotox that has investigated the influence of 'plastic chemical' and other endocrine disrupting chemicals on maternal and child health will be presented. Our research has investigated the influence of "plastic chemicals' in combination with other endocrine disruptors on maternal health and child health outcomes. We showed that higher concentrations of phthalate metabolites and PFAS during pregnancy were associated with increased odds of pregnancy-induced hypertension. Further, higher concentrations of phthalate metabolites during pregnancy were associated with increased weight and fat mass during pregnancy and postpartum among women with an overweight or obese pre-pregnancy body mass index and higher prenatal exposure to phthalate metabolites and bisphenols was associated with higher odds of children developing allergic conditions in early childhood. In terms of neurodevelopment, we found that higher levels of prenatal exposure to these chemicals were associated with less developed brain structure in children, that less developed brain structure was associated with more behaviour problems in children and that brain structure differences may explain these associations. We have also demonstrated that prenatal and postnatal exposure to bisphenols and phthalates are associated with poorer cognitive and behavioural outcomes in children and that these associations differed for male and female children. Our research team has also examined the association between of prenatal exposure to 'plastic chemicals and infant epigenetic profiles. In an epigenome wide association study, we reported that 12 CpGs and 12 CpGs in buccal endothelial cells (BECs) were associated with prenatal exposure to phthalates. Higher prenatal exposure to high and low molecular weight phthalates was associated with altered DNA methylation in infants at CpGs annotated to genes associated with hormone activity, immune system function, and neurodevelopment. We have also reported that higher prenatal exposure to DEHP, a high molecular weight phthalate, was associated with more colds during early childhood, and epigenetic age acceleration mediated this association in boys. Further, we found that higher prenatal exposure to phthalate metabolites and bisphenols was associated with sex-specific deviations in epigenetic age acceleration in infants at 3-months of age.

Socioeconomic latent classes modify the relationship between maternal PFAS exposure profiles and perinatal outcomes in the Norwegian Mother, Father and Child Cohort Study (MoBa)
- Adriano Winterton (E)

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Intrauterine exposures to environmental contaminants potentially impact a wide range of adverse health outcomes in childhood and later in life. Understanding the interplay between susceptibility, lifestyle and environmental exposure that underlies these conditions is becoming ever more important. This study investigated the interplay between socio-economic status (SES – described through marital status, maternal education, household income, and a subjective struggle to subsist on that income) and prenatal exposure to seven per- and polyfluoroalkyl substances (PFAS) in influencing placental weight, birth weight, and the birth weight to placental weight ratio among children in the Norwegian Mother, Father and Child Cohort study (MoBa). It employed latent profile analysis (LPA) and latent class analysis (LCA) to identify distinct PFAS exposure profiles and SES classes, respectively, and explored how these factors may interact to impact perinatal outcomes. Among the 3,435 participants included in this study, four PFAS exposure profiles were identified, and were associated with significant differences in placental and birth weight, which may be indicative of compromised placental efficiency. Concurrently, three patterns of SES were identified, highlighting income and educational disparities. A latent transition analysis was then used to test for effect measurement modification, demonstrating that these SES patterns modify the association of PFAS with placental and birth outcomes, suggesting a nuanced interplay where socio-economic stressors may exacerbate the adverse effects of chemical exposures, or protect against them. This finding underscores the need to integrate SES into environmental health studies and prompts further investigation into the complex dynamics between socio-economic factors and prenatal toxicant exposure to better understand their implications for long-term health outcomes. Our findings that different combinations of PFAS can have distinct effects on perinatal outcomes, as well as distinct interactions with SES factors also support the importance of modelling the PFAS with suitable methods, for example defining different mixture indexes of PFAS subclasses in the same model, such as perfluorocarboxylic acids and perfluoroalkyl sulfonates.

Health at the Heart of Plastic Governance: A Grassroots-Informed Risk Framework for Vulnerable Populations

- Ahmed Tiamiyu (E)

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Plastics are increasingly burned as alternative fuels in cement kilns across Nigeria, with little assessment of the associated human health risks. In 2023, Community Action Against Plastic Waste (CAPws) and Break Free From Plastic (BFFP), undertook a grassroots health campaign ahead of the third session of the Intergovernmental Negotiating Committee (INC3) on plastic pollution. The campaign focused on Obajana, Kogi State, where the Dangote Cement plant co-processes plastics in its kilns. Community-led health surveys involving 313 households revealed that 41% of residents reported persistent upper respiratory symptoms (chronic cough, throat irritation), compared with 13% in a neighboring community 15 km away. Skin irritations and rashes were reported by 27% of Obajana respondents, compared with 7% in the control community. Eye irritation and watering were cited by 33% of households near the kiln, nearly triple the rate in the control group. Women and children reported higher symptom prevalence, aligning with their greater exposure time near homes and water sources adjacent to the plant. Participatory risk mapping confirmed widespread exposure to smoke plumes and particulate fallout, with residents noting increased ash deposits on rooftops and open water containers. While no biomonitoring or chemical assays were available, community observations strongly indicate chronic exposure to airborne microplastics, dioxins, and plastic-associated additives released during co-processing. Voiceless grassroots communities living on the frontlines of plastic pollution carry the heaviest health burden, yet their experiences are often absent from data, monitoring, and decision-making. Citizen science provides a powerful bridge, enabling affected residents to generate evidence, document exposure, and assert their right to be heard. The growing health impacts of plastic pollution are a profound human rights issue, threatening the right to health, safe environments, and dignity for vulnerable populations. Our findings demonstrate how grassroots epidemiological evidence can complement formal toxicology and risk assessment, particularly in low-resource settings where industrial monitoring is absent. We propose a grassroots-informed risk assessment framework that integrates lived experience, rapid exposure surveys, and policy advocacy. This framework can strengthen global plastic governance by focusing on vulnerable populations excluded from formal monitoring and regulation.

Grouping of chemicals into human-readable groups: a case study on food contact chemicals
- Helene Wiesinger (E)

Helene Wiesinger[1], Lindsey Parkinson[1,2], Birgit Geueke[1], Albert Anguera Sempere[1], Justin Boucher[1], Etienne Cabane[1], Martin Scheringer[3], Jane Muncke[1]

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Chemical safety of food contact materials is increasingly recognized as critically important. Still, many materials contain chemicals that lack hazard data, which prevents hazard and risk assessment. Furthermore, current chemicals management can lead to regrettable substitutions, i.e. where a hazardous substance is replaced with an equally or more harmful substance that lacks relevant hazard data. Such regrettable substitutions can be avoided by grouping structurally similar chemicals, because they may show similar hazard profiles. We have developed a methodology for grouping chemicals into human-readable and structure-based groups. The approach is semi-automatic, modular, and thoroughly quality-checked. It integrates multiple techniques, including SMARTS-based structural pattern matching, curated list comparisons, keyword searches, and ontology-based classification via ClassyFire, followed by iterative refinement to ensure accuracy. Applied to a dataset of over 7'629 known plastic food contact chemicals (FCCs), our method classified 5'176 as organic (including 2'528 organo-oxygen compounds, 1'388 with multiple heteroatoms, and 905 hydrocarbons), 588 as organometallic, 410 as inorganic, and 1'455 as not groupable due to missing structural data. In addition to the hierarchical classification, we identified priority groups containing hazardous or commonly detected food contact chemicals. These include hindered phenol derivatives (16 hazardous of 132 total), organophosphates (15 of 95), PFASs (26 of 94), metals (26 of 85), primary aromatic amines (38 of 69), ortho-phthalates (20 of 63), organotins (27 of 47), and siloxanes (6 of 44). Of the combined 1'952 plastic FCCs assigned to priority groups, 299 are known to be hazardous, while 1'387 lack hazard data, highlighting key targets for future research. Our grouping method provides a practical and scalable foundation for better chemicals management in materials. It supports prioritization for targeted data gap filling, highlights chemical groups that have the potential for regrettable substitution, and enables group-based regulatory approaches.

Advancing Chemicals Risk Management Through Cheminformatics and Data Integration
- Daniel Weber (E)

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Managing chemicals across their lifecycle is complicated by fragmented domestic and international regulations, especially for chemicals in imported goods and materials (e.g., plastics). These chemicals can pose health and environmental risks or affect circular economy outcomes. Addressing this complexity requires advanced data analytics and integrated platforms that deliver clear, actionable insights for decision-makers. Over recent years, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) has developed and deployed the Australian Regulatory Chemical Informatics Engine (ARChIE), a centralised web-based platform that integrates global regulatory data, risk-relevant scientific information, and cheminformatics capabilities. ARChIE now supports routine activities including industrial chemical assessments, scheduling under the Industrial Chemicals Environmental Management Standard (IChEMS), and contaminated site assessments. This presentation will highlight recent enhancements to ARChIE to include chemical concentrations measured in environmental media and consumer products. These additions, which are applicable to plastics, now enable prioritisation based on real-world exposure, chemical structure, global regulatory status, and hazardous properties. They also establish a pipeline for research-generated data to be packaged, contextualised, and deployed within a regulatory setting, helping to inform priorities across the broad spectrum of policy areas engaged in chemicals risk management.

Utilising evidence on PFAS to inform regulation, policy and behavioural change
- Louise Goodes (E)

Louise Goodes[1,2], Sarah Dunlop[1,2]

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Acknowledgements: Dr Yan Mulders and Dr Aleksandra Gozt (PHH), the Advocacy & Engagement team (A&E), Minderoo Foundation)

Translation of research on chemicals to health protective measures requires communication to diverse audiences with varying degrees of technical background and different information needs. We present two related Case Studies (CSs) on research translation by Plastics & Human Health (PHH), Minderoo Foundation, addressing per/polyfluoroalkyl substances (PFAS), until recently unrestricted in Australia. The first (CS-1) involved submitting evidence to inform scheduling of PFAS on the Industrial Chemicals Environmental Management Register (Dec 2022), and the Australian Select Senate Inquiry into PFAS (Jan-Mar 2025). CS-2 involved communicating evidence to Advocacy & Engagement specialists (A&E) to develop web and social media communications to inform general audiences about PFAS and protecting their families (2024-25). PFAS exposure via diet and drinking water was prioritised, as the main sources in general populations. The Food Packaging Forum FCCmigex database provided evidence on PFAS detection and migration from plastic and paper-based food contact materials (FCMs). Health impacts were drawn from epidemiological evidence synthesised in a PHH umbrella review (UR). Both CSs use non-scientific language to outline exposure sources, particularly plastic (by polymer) and paper-based FCMs (entirely preventable sources); ways to reduce personal exposure; and UR findings: significance of evidence; no PFAS can be considered safe; consistently associated birth, neurodevelopmental, respiratory, endocrine/metabolic, cardiovascular and pregnancy health harms. Approach, detail and messaging style was specific for each CS. CS-1 submissions included scientific support for addressing PFAS as a class, on the basis of high persistence, UR evidence and to prevent ongoing "regrettable substitution". Regulatory progress in other countries was summarised and the need for a cohesive global response acknowledged. In CS-2, A&E developed strategic digital storytelling on PFAS and protecting health, targeting Australian audiences, reviewed continually by PHH for scientific accuracy. Following CS-1 submissions, the Australian Government introduced bans on PFOA, PFOS and PFHxS (Jul 2025); the PFAS Senate Inquiry is ongoing. CS-2 contributed to a plastics campaign reaching >14 million people globally, with 5400 e-book downloads and 9000 e-newsletter subscriptions. Clear communications of independent scientific evidence to target audiences are critical to drive change and protect health.

Minnesota affordable housing policies lead the way in encouraging avoidance of worst in class plastic building materials and selection of healthier alternatives
- Teresa McGrath

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In 2024, Habitable published a groundbreaking report analyzing 36 affordable housing developments in Minnesota. The findings were stark: over 70% of the commonly used building products in the categories surveyed across these projects were classified as among the worst in class from a material health perspective, most of which were plastic materials. This data-driven revelation catalyzed a significant policy response from the Minnesota Housing Finance Agency (MHFA), marking a critical inflection point in the intersection of housing, health, and sustainability. Projects that receive funding from MHFA are required to meet the Minnesota Overlay to the Enterprise Green Communities Criteria, a green building standard for affordable housing. In the 2025–26 version of the Overlay, MHFA integrated new incentives aimed at reducing the worst in class materials in publicly funded housing. For the first time, affordable housing project teams can now earn optional integrative design points by participating in a healthy materials training that highlights the use and release of hazardous chemicals throughout building products' life cycles and provides guidance on how to select healthier options. Additionally, the Overlay rewards teams that eliminate worst in class products and prefer healthier alternatives in their projects. More than 40 Minnesota-based affordable housing practitioners participated in the training sessions held in June and July 2025, representing thousands of units, which is an early indicator of the impact this policy change will have. As projects developed under the updated Overlay move into design and construction phases, this policy change and others like it are poised to shift the buying practices of project teams, reducing the demand and eventually the production of worst in class materials. This case study offers a model for how national and sub-national housing agencies can operationalize plastics and toxic chemical reduction strategies through existing green building policy levers. It also highlights the power of public-interest research to drive real-world policy shifts—moving beyond awareness into systems change. Findings from this effort will inform regional, national, and international conversations about how regulatory frameworks can address the hidden health costs of plastics and other harmful building materials.

From National Policy to Local Crisis: Institutional Fragmentation, Open Burning, and Health Risks from Plastic Pollution in Kandy, Sri Lanka

- Dinushika Yapa Abeywardhana (E)

Dinushika Yapa Abeywardhana[1]

[1] *University of Peradeniya, Sri Lanka*

Plastic pollution and waste management remain urgent challenges for many developing countries, and Kandy, Sri Lanka, exemplifies how national policy ambition falters at the municipal level, cascading socio-environmental harms. This sociological study, based on non-participatory observation, 25 in-depth interviews across socioeconomic strata and municipal officers, and a review of secondary sources, interrogates the gap between Sri Lanka's National Policy on Waste Management (2019) and on-the-ground realities. Although the national policy articulates life-cycle management, Extended Producer Responsibility (EPR), and polluter-pays instruments, Kandy lacks binding municipal action plans, time-bound targets, and transparent performance metrics. Institutional fragmentation disperses responsibility across agencies, undermining coordination and uniform enforcement of planned policies. Infrastructure deficits, financing shortfalls, and the absence of reliable collection prompt open burning and informal disposal, contributing to Kandy's poor air quality and likely increasing microplastic contamination of local food and water pathways. Household plastic generation is strongly linked to socio-environmental status, while the romanticization of reusable bags has not demonstrably reduced overall plastic throughput because product design, retail practices, and market incentives continue to favour disposables. The informal recycling sector remains marginalised and deprived of occupational protections, reducing reclamation rates and amplifying social precarity. Consequences—clogged drains, intensified urban flooding, livelihood damage, potential long-term health risks, psychological stress, and erosion of community cohesion and civic trust—reflect how unsustainable municipal measures, weak enforcement, and fragmented coordination exacerbate harm. The study calls for municipal operationalization of national mandates through enforceable Kandy action plans; operational waste management that formally integrates and protects informal actors; robust collection monitoring; immediate drainage and collection interventions; and sustained public education and community-driven initiatives to transition Kandy toward a circular plastics regime and restore environmental and social wellbeing. Keywords: environmental justice; environmental health; plastic pollution; policy limitations; quality of life.

Plastics Governance in Nigeria and Sub-Saharan Africa: Pathways to a Circular Future

- Temilola Oluseyi

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African countries are increasingly adopting various strategies to combat plastic pollution, including bans on single-use plastics, product standards, extended producer responsibility (EPR) schemes, and import controls. However, the implementation of these policies varies significantly across the continent. Nigeria, Africa's most populous nation and a major market for plastics, exemplifies both the potential and challenges of policy reform in this sector. This study provides a comparative policy analysis of plastic governance in selected African regions, with a focus on Nigeria. It maps national and subnational policies along the plastics value chain, such as design, production, consumption, collection, recycling, and end-of-life management, in order to evaluate their alignment with circular economy principles. This study employs a mixed-methods design that combines a doctrinal review of statutes and regulations with stakeholder interviews involving regulators, producers, recyclers, and informal-sector participants. The findings underscore the development of Nigeria's Extended Producer Responsibility (EPR) framework, under the National Environmental Standards and Regulations Enforcement Agency (NESREA). The Lagos State Plastic Waste Management Framework (2023) introduces pathways for producer compliance, encourages the development of recycling markets, and integrates informal waste collectors into formal value chains. However, several challenges persist, including gaps in product standards, labelling, traceability, and market incentives for recycled content. Benchmarking against regional frameworks, such as the African Union's Guidelines for Plastics Pollution Management and ECOWAS's Regional Action Plan on Marine Litter and Plastic Waste, along with global best practices, reveals significant policy fragmentation. However, there is a growing convergence toward circular economy principles. This study proposes a reform blueprint specific to Nigeria, which emphasises the clear delineation of roles between federal and state governments, a ban on single-use plastics, eco-modulated EPR fees, recycled content standards, fiscal incentives, and inclusive waste governance. By examining the Lagos experience within the broader context of Africa's evolving plastics governance landscape, this research provides a practical roadmap for establishing harmonised, circular, and socially inclusive plastics management systems across the continent.

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2	The Food Contact Chemicals Priority List (FCCprio List)	**Helene Wiesinger**, Food Packaging Forum Foundation
3	Identification and prioritisation of microplastics and chemical additives in cropping systems	**Mike Williams**, CSIRO
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85	Hidden Microbial Reefs Attached to Plastics can Harbour Pathogenic and Drug-resistant Organisms	**Emily May Stevenson**, University of Exeter
86	Prenatal exposure to a phthalate mixture increases internalising problems in early childhood partly via maternal oxidative stress	**Sarah Thomson**, The Florey Institute of Neuroscience and Mental Health
87	What risks do dietary bisphenol exposures pose to female fertility?	**Jessie Sutherland**, University of Newcastle; Hunter Medical Research Institute
88	You are What you Eat: Determining Microplastic Risk in Australian Agricultural Systems	**Scott Wilson**, RMIT University/Solving Plastic Waste CRC
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Poster Abstracts

1. From Plastic Chemicals to Human Impact: An Architecture for AI Agents to Navigate Relational Databases

- Albert Anguera Sempere

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The global crisis of plastic pollution is escalating, with mounting evidence linking chemical exposure from plastics to serious health and environmental risks. As concerns regarding plastic chemicals hazards continue to grow, development of tools that support linking their toxicological effects and identifying safer alternatives is needed. If chemical hazard data were easier to navigate and connect, researchers and policymakers could make timely, science-based decisions to restrict harmful chemicals. Currently, extracting and connecting meaningful information from chemical databases is time-consuming and requires specialized technical knowledge, resulting in promising ideas stalling. This hinders innovation in areas where speed and clarity are critical, such as unveiling plastic-related chemical hazards. Generative AI offers the opportunity to use intuitive natural language to access structured data, such as complex chemical databases. Despite its potential to make scientific data more Findable, Accessible, Interoperable, and Reusable (FAIR), its applications in chemical and human-health databases are still underexplored. To address this gap, we developed an AI Agent that interacts with ChEMBL—one of the largest chemical databases—using natural language. ChEMBL was selected for its high data quality and complexity, making it a suitable benchmark for our approach. The Agent consists of three core modules: (i) Relevance Validation, which checks if the user's query aligns with ChEMBL's domain; (ii) Query Enhancement, which enriches the query with missing context and logical steps; and (iii) Table Retrieval, which uses Retrieval-Augmented Generation (RAG) to match the enhanced query with relevant database tables stored in a vector database, and then generates a corresponding SQL query. If the query fails, the Agent enters a feedback loop: the error message is appended to the original query and used to regenerate the SQL. This process is repeated up to three times, to optimize computation and time. If no valid query is produced, the user is notified. Results are displayed in a user-friendly table, which can be refined through natural language and downloaded as a CSV file. The tool can be used to assess bioactivity effects of common plastic chemicals. This architecture can be extended to other chemical databases, such as our food contact chemical and human-health databases—connecting food contact chemicals usage with exposure and adverse health effects.

2. The Food Contact Chemicals Priority List (FCCprio List)

- Helene Wiesinger

Helene Wiesinger[1], Lindsey Parkinson[1,2], Birgit Geueke[1], Albert Anguera Sempere[1], Justin Boucher[1], Etienne Cabane[1], Martin Scheringer[3], Jane Muncke[1]

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Food packaging is essential for preserving food quality and extending shelf life but can also pose environmental and health risks due to resource use, pollution, and chemical exposure. The Understanding Packaging Scorecard (UP Scorecard) is an evidence-based tool for assessing the impacts of food packaging on health and the environment, including chemicals. So far, its chemicals assessment metric has not been based on a systematic, evidence-based, and unified method approach. To address this, we created the FCCprio List - a list of priority food contact chemicals integrated into the UP Scorecard. The FCCprio List was created by applying the evidence-based PlastChem methodology to over 15'000 known food contact chemicals, 7'629 of which are associated with plastic food contact materials. Using GHS-aligned hazard data from regulatory bodies, chemicals were prioritized if they met any of the following criteria: "carcinogenic", "mutagenic", "toxic for reproduction", "toxic for specific target organs from repeated exposure", "endocrine disrupting", "persistent, bioaccumulative & toxic", "very persistent & very bioaccumulative", "persistent, mobile & toxic", or "very persistent & very mobile". Prioritized chemicals were ranked into four tiers based on their evidence for human exposure from food contact materials. In total, 807 plastic food contact chemicals are hazardous based on the used hazard data, with 88 known to migrate from food contact materials and detected in national human biomonitoring programs (Tier 1). 238 migrate from food contact materials but were not detected in national human biomonitoring programs (Tier 2). 161 have been detected in food contact materials but are not known to migrate (Tier 3). And 320 have not been detected experimentally but are listed for use in the production of food contact materials (Tier 4). Among all hazardous food contact chemicals (overall: 1'222, Tier 1: 94, Tier 2: 264, Tier 3: 224, Tier 4: 640), a substantial fraction is relevant to plastics (66%), surpassing the proportion observed for other major materials utilized in food contact. A large share (82% for plastic food contact chemicals, 86% for all) lack relevant hazard data and could not be considered for prioritization, suggesting a significant risk for regrettable substitutions. The FCCprio List helps in identifying, screening, and avoiding the most hazardous chemicals and supports the development of safer and more sustainable food contact applications.

3. Identification and prioritisation of microplastics and chemical additives in cropping systems - Mike Williams

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Although microplastics have been increasingly detected in soil environments, it is still unclear how these quantities translate into potential effects on crops grown in agricultural soils contaminated with microplastics. Furthermore, the knowledge relating to the effects of microplastics on biological systems is still emerging, especially when assessing the extent to which the morphology of the microplastic or the chemical additives present within the polymer structure are driving a biological response. This paper will give an overview of the first stage of a project that aims to identify chemicals using high resolution mass spectrometry (HRMS) present in common plastic products comprised of a range of common polymers. Direct analysis of microplastics (using TGA TED GC QTOFMS) and microplastic extracts (using LC Orbitrap and GC QTOFMS) will be used for characterising chemical additives. The use of these HRMS techniques will allow us to (a) verify the presence of chemical additives that have previously been documented as being associated with plastic manufacture in databases (e.g. PlastChem DB) and (b) determine additives most commonly associated with classes of polymer so that existing quantitative information for microplastics in soils can be linked to hazardous chemical additives. For part (b), hazard information for chemical additives identified in plastic materials will be collated from various sources (e.g. ECHA, USEPA). This will allow chemical additives to be ranked according to their potential hazard, categorise polymer classes that contain the most hazardous chemicals and, therefore, identify microplastic polymers of highest concern. The outcomes from the first stage of the project will be used for designing exposure scenarios for microplastics and hazardous chemical additives in cropping systems containing organic soil amendments (both fresh and historical), where crop uptake of microplastics (and additives) and impacts on soil microbiology will be assessed. The characterisation of microplastics in the organic soil amendments will also be discussed, including the use of other visualisation methodologies (e.g. FTIR microscope) to support the conclusions for this second stage of the study.

analytics

4. Defining Unequivocal: Increasing Confidence In The Analysis And Reporting Of Micro- And Nanoplastic Particles In Biological Matrices

- Grace Davies

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The accurate quantification and characterisation of particles within biological systems is critical to assess potential health risk. However, identification of nanoplastics (<1µm) and small microplastics (<10µm) remains an analytical challenge, exacerbated in complex human samples. Concerns regarding the potential impact of plastics on human health has, however, led to increasing numbers of studies aiming to identify small micron and nanoplastics within human tissues. Mass based quantification methods such as pyrolysis gas chromatography mass spectrometry are being increasingly used in attempts to identify and quantify small plastic particles in biological samples. However, this indirect analysis method is susceptible to sample matrix interference (e.g., due to the presence of lipids in biological tissues), resulting in quantification being unreliable for certain plastics such as polyethylene and polyvinyl chloride. Furthermore, no morphological information is provided, which is important toxicologically relevant information needed to inform accurate risk assessments. Optical microscopy coupled to spectroscopic methods such as Raman or Fourier-transform infrared are widely used for microplastic identification, however for smaller nano-sized particles, the resolution is not sufficient to accurately identify individual plastic particles. Therefore, we propose a framework to increase confidence by using multiple orthogonal techniques to identify plastics in biospecimens. The techniques use fundamentally different approaches which measure the same physical properties of a suspected plastic particle. Three categories of techniques are proposed, based on the amount of information they provide about chemical identification, morphology, and other physicochemical properties. The application of multiple techniques is proposed to enable unequivocal identification within complex matrices. Examples of potential analytical techniques will be presented, with their benefits and drawbacks highlighted to exemplify how the framework can be used. The limitations of each technique will be identified, and the framework requires that such limitations are clearly communicated when research data are reported to ensure transparency. This framework is proposed as a starting point for future minimum standards regarding publishing human internal exposure data, which will be critical for human health research and future risk assessment.

5. An All-Inclusive Pipeline for Quality Control Checks and Sample Grouping in PY-GC-HRMS Micro- and Nanoplastic Quantitation Utilizing Skyline and R-Programming

- Christian Dior Freeman

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Micro- and nanoplastic particle (MNPs) analysis aren't suitable for traditional quantitation methods like liquid chromatography and gas chromatography- mass spectrometry (GC-MS). Pyrolysis-GC-MS, which pyrolyzes plastic particles in the absence of oxygen to produce a polymer fingerprint, has shown promising results for consistent instrument detection of MNPs at levels ranging from 0.01-0.04 ug/g for multiple plastic polymers (1). Despite this, data analysis, quality control, and statistical evaluation of sample groups lack a routine structure in literature. Spectral matching algorithms exist for identifying and quantifying MNP particles, however, this workflow may introduce inaccuracy when matrix interferences are present and chromatogram shifts during peak alignment aren't accounted (2). Here we propose a data analysis pipeline geared toward processing raw PY-GC-MS data in a more routine and traditional route, where quality control and statistical results for sample batches can be determined simultaneously. A Skyline processing template was set up to prioritize batch processing, peak identification, and pre-quantitation checks for normalized and un-normalized target-ion peak areas prior to post processing. Extracted ion areas were processed externally using R, for both normalized and unnormalized areas. The post-processing script determines variance among QC samples across batches and compares internal standard detection intra-batch. Trace polymer concentrations were calculated using calibration curves, and multi-variate statistics were applied for grouping of unknown samples, separating sample groups according to MNP concentrations for filtering outliers or contaminated samples. This workflow achieves method quality control and sample quality intra or inter-batch checks. Multi-variate statistics can also be applied to sample unknown group assignments to distinguish patterns related to sample morphology yielding pre-liminary connections between sample collection and microplastic deposition. This approach combines QC and sample integrity monitoring with statistical grouping for a more efficient workflow. (1) Ana, T.-A. et al. Journal of Hazardous Materials 2024, 469, 133981. DOI: https://doi.org/10.1016/j.jhazmat.2024.133981. (2) Kazuko, M. et.al. Journal of Analytical and Applied Pyrolysis 2020, 149, 104834. DOI: https://doi.org/10.1016/j.jaap.2020.104834.

6. Confirming Characteristic Pyrolysis Features of Microplastics in Placental Tissue

- Ronald Smith

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Increasing demand for biologically relevant microplastics data has outpaced the literature in terms of quality control, harmonization and transparency. For example, an inter-laboratory study found substantial variation in mass quantification across labs, emphasizing the critical need for robust calibration materials. Additionally, recent analyses report that many published microplastics studies do not include adequate QA/QC procedures such as blanks or recovery spikes. Our work aims to begin addressing that gap by developing reproducible calibration materials for Py-GC-MS in placental tissue. Robust quality control development begins with proper identification of plastics in chromatograms. Aside from matrix and background interferences, careful consideration should be made for plastics which may share pyrolyzates. In this study, we prepared polymer reference solutions via microwave-assisted dissolution in DCM and spiked them into prepared filter punches of placental matrix. Detected features were graded across multiple criteria to ensure the selection of characteristic and reproducible peaks. Media blanks of blank filter paper and calcium carbonate were analyzed to account for sample preparation background. We prepared an instrument calibration using Frontier's polymer mix in calcium carbonate to assess recovery and accuracy of the reference solutions. While each polymer's dissolution in DCM may not be reliable enough to serve as quantitative standards, they are a useful means to providing proper peak identification and verification.

7. ISO compatible, efficient and reproducible protocols/equipment for micro-nanoplastic detection through machine-learning - COST Action ICPLASTIC

- Gabriela Kalčíková

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ICPLASTIC is an ambitious COST Action focused on one of the most pressing and complex challenges in environmental science today: harmonising and advancing methods for the detection, characterization, and risk assessment of micro- and nanoplastics (MNPs). The need for this Action stems from recognised gaps in both methodology and regulation. While micro- and nanoplastics are known to be widespread in environmental compartments, the scientific community currently faces inconsistencies in sampling strategies, sample preparation protocols, analytical workflows, and data comparability across laboratories. These limitations hinder the reliable assessment of MNP occurrence, distribution, and potential health and ecological risks. ICPLASTIC directly addresses these challenges by uniting an interdisciplinary, transnational network of researchers, technologists, instrument manufacturers, regulators, and other stakeholders. Through collaboration and shared expertise, the network aims to define consensus protocols and equipment specifications that facilitate reproducible and legally relevant measurements of MNPs across Europe and beyond.

The Action also emphasises capacity building and community development. It includes a structured organisation of Working Groups (WGs) that focus on specific thematic areas such as sampling methods, analytical technologies, data management, toxicology/risk assessment, and standardisation. These collaborating groups provide platforms for scientific discussion, joint experiments, interlaboratory comparisons, training schools, and knowledge exchange across disciplines and sectors. By doing so, ICPLASTIC not only formulates harmonised protocols, but also nurtures a next generation of researchers and innovators with the skills needed to sustain and expand this rapidly evolving field.

Funded under the COST framework by the European Union, ICPLASTIC invites participation from scientists across Europe and associated countries. Through its open and inclusive network model, the Action enhances transnational collaboration, drives standardisation efforts, and builds a foundation for future innovation in MNP science and technology.

8. Dialling Down the Heat: Assessing Nanoplastic Standard Recoveries in a Simulated Oxidative Digestion Protocol

- Nathan Charlton

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The detection and quantification of nanoplastics in complex biological matrices requires extraction protocols that effectively remove organic material whilst preserving the integrity of nanoplastic particles. In literature, oxidative digestion using 30% hydrogen peroxide (H2O2) is a common approach, yet the impact of digestion temperature on nanoplastic recovery has not been extensively studied. This experiment evaluated the effect of temperature, without matrix, on the recovery of seven nanoplastic standards with an oxidative digestion protocol using 30% H2O2. Virgin, non-functionalised nanoplastics (400-500 nm) – polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), polyvinyl chloride (PVC), Nylon 6, polystyrene (PS), and polymethylmethacrylate (PMMA) – were spiked in duplicate into 100 mL of 30% H2O2 and subjected to the digestion protocol at four temperatures (38°C, 60°C, 75°C, and 90°C) over a one-week period. Samples were filtered using 0.3 µm glass fibre filters, and residual polymer content was quantified with Pyrolysis–Gas Chromatography–Mass Spectrometry (Pyr-GC/MS). Experimental results suggest an inverse relationship between digestion protocol temperature and polymer recovery. PET and Nylon 6 exhibited significantly reduced recoveries at higher temperature (from 38°C to 90°C: 25 down to 3% and 77 to <1%), with near-total degradation for both observed at 90°C. PE, PP, PS and PMMA demonstrated comparatively higher stability up to 75°C, with maintained moderate to good recoveries (mean 30-130%), however recoveries again decreased at 90°C. These findings have significant implications for nanoplastic analysis in complex biological samples. While elevated digestion temperatures during an oxidative digestion protocol are expected to reduce matrix interferences, such an approach risks extensive degradation of specific polymers. This underscores a critical trade-off: more aggressive digestion conditions may reduce matrix interferences but can compromise detection and quantification of nanoplastics. As a consequence, optimisation of digestion protocols to balance effective removal of organic matter with minimal polymer degradation is essential for the robust and reliable quantification of nanoplastics in complex environmental and biological contexts.

Funded under the COST framework by the European Union, ICPLASTIC invites participation from scientists across Europe and associated countries. Through its open and inclusive network model, the Action enhances transnational collaboration, drives standardisation efforts, and builds a foundation for future innovation in MNP science and technology.

9. PiAutoVision: An Open Source System for Automated Marine Microplastic Analysis Using Computer Vision and Optical Microscopy

- Jesse Casey

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Small microplastic particles (<300 µm) are increasingly recognised in marine surface waters, however, their characterisation remains bottlenecked by manual microscopy and inconsistent analytical workflows. We developed PiAutoVision to address these challenges by automating microscopy and integrating computer-vision models with existing laboratory hardware. Building on the open source PiAutoStage platform, PiAutoVision provides a unified, user-friendly interface that integrates automated image acquisition, focus control, and particle analysis. The system is modular and adaptable to various microscope configurations. It couples an Olympus BX53 microscope and DSLR camera to a 3D-printed motorised stage controlled by a Raspberry Pi running Flask-SocketIO. Communication with a laptop interface via WebSockets enables smooth stage movement, automatic image capture, local storage, and live blur-map visualisation for real-time focus assessment and image quality control. This design allows researchers with minimal technical experience to perform high-throughput imaging, preprocessing, and image stitching within a single framework. For initial tests, marine surface samples were collected from sites across the Samoan Islands, and filtered through 70 µm glass fibre filters, and analysed using the PiAutoVision workflow. The computer vision pipeline automatically optically sorts and categorises particles through a Grounded-DINO (a natural-language-guided object detector) and the Segment Anything Model (SAM) which is significantly faster than humans and decreases random error. The particles are classified by size, shape, and colour; selected particles are flagged for ATR-FTIR. The resulting spectra are processed through machine-learning algorithms to predict polymer type and visualised in interactive HTML maps linking trawl location with particle abundance and morphology. The combination of open source automation, optical microscopy, and AI-assisted analysis allows PiAutoVision to provide a scalable, reproducible, and low cost workflow for microplastic characterisation. This approach significantly reduces analysis time, improves reproducibility between operators, and lowers the technical barrier to high quality microplastic research. Journal of Analytical and Applied Pyrolysis 2020, 149, 104834. DOI: https://doi.org/10.1016/j.jaap.2020.104834.

10. Developing a robust quantitative method for analysing microplastics in blood using Pyrolysis GC-MS

- Amber Vaughan

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Pyrolysis Gas Chromatography Mass Spectrometry (Py-GC-MS) is an established analytical method for quantifying micro and nano plastics (MNPs), with many studies using this technique to evaluate the presence of plastics in human samples, for example in blood, bone marrow and sperm. Meanwhile, investigations into the impact of matrix effects on polymer response for Py-GC-MS, such as the influence of inorganic matrices on polyethylene terephthalate (PET) markers, are ongoing, and the recovery rates for Py-GC-MS analysis of MNPs in human tissues have been variable in the literature. This study investigates the recovery and marker response of three different polymers previously examined in human blood – polyethylene (PE), polypropylene (PP) and PET using 1 dimensional Py-GC-MS and the presence of quartz fibre filter (QFF) and blood matrices. Matrix effects were assessed using blank QFFs and QFFs with commercially available blood digested using published methods. These were then spiked with polymers at concentrations between 100 ng and 7000 ng. In addition, recovery tests for MNPs spiked into blood as suspensions and solids at ~1000 ng prior to digestion were compared to both matrix matched and non-matrix matched calibration curves. Preliminary data indicates a peak area reduction for markers of each of the polymers when comparing polymer spiked QFF without digested blood to polymer alone, with more than 20% difference observed in some cases following mass and internal standard correction. However, further investigation into the quantification of this effect is required. The cause of this difference is suspected to be due to the influence of inorganic impurities on the QFF and of metals present in blood, which warrants further research. In addition, using QFF matrix matched calibration curves was found to improve recovery results, as demonstrated by a 33.6% higher recovery rate for blood spiked with PET suspension prior to digestion. The findings of this study provide insight into the need for matrix-matched quality control checks when analysing MNPs in human blood using Py-GC-MS and highlight the complexity of analysing MNPs in real-world matrices.

11. Tracking tyre wear compounds in the River Brent: a citizen science approach
- Helena Rapp Wright

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Tyre, brake, and road abrasion particles may contribute up to 80% of ambient particulate matter below 10 µm aerodynamic diameter (PM_{10}), posing environmental and public health concerns. Tyre-wear products (TWPs), generated through friction between tyres and road surfaces, have recently been classified as microplastics. These particles disperse via air and runoff, contaminating air, soil, and water systems. Toxicological studies link TWPs to cardiopulmonary complications, carcinogenicity, reproductive toxicity, and risks to aquatic life due to their persistence and chemical composition. Despite their toxicity and increasing road traffic, UK-based studies remain limited. This study focuses on the River Brent, a tributary of the River Thames in Greater London (UK), which flows through a densely urbanised catchment with major roads and residential zones. Its exposure to stormwater runoff and vehicular emissions makes it a strategic site for monitoring tyre wear-derived contaminants. Target compounds included TWPs such as N-(1,3-dimethylbutyl)-N′-phenyl-phenylenediamine (6PPD) and its quinone (6PPDQ), hexamethoxymethylmelamine (HMMM), and 1,3-diphenylguanidine (DPG), alongside other contaminants of emerging concern (CECs). Sampling was conducted by trained community groups in 2025, following a training session to ensure standardised procedures. Over 100 samples were collected and analysed, covering both dry and wet summer conditions to capture seasonal variability. Samples were analysed using a rapid, high-throughput direct-injection liquid chromatography coupled to mass spectrometry (LC-MS/MS) method, quantifying over 100 chemicals at low ng/L concentrations. The method used a 5 mm biphenyl cartridge and only 10 µL of filtered sample per injection, with a runtime under 5 minutes. Across all samples, 41 compounds were detected out of 174 screened, with average concentrations of 545 ng/L for HMMM, 39 ng/L for DPG, and 14 ng/L for 6PPD-Q. A strong correlation was observed between HMMM and DPG (R^2 = 0.87), suggesting shared sources or transport mechanisms. This work will present the analytical development, validation, and application of a rapid screening method for TWPs in urban river systems. Sampling from the River Brent offers valuable insight into the environmental fate and transport of non-exhaust vehicle emissions, contributing to broader efforts to assess and mitigate chemical pollution in aquatic environments.

12. Microplastics and Halogenated Persistent Compounds in the Southwestern Atlantic: From Environmental Occurrence to Bioindicator Species and Human Health Risk
- Rocio Luciana Bray

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Microplastics (MPs, plastic particles < 5 mm) are widespread, persistent, and emerging pollutants. They enter the ocean through domestic and industrial wastewater, land runoff, and riverine discharges. Once in the marine environment, oceanographic processes govern their distribution. Despite growing concern, the levels, distribution, and behavior of MPs in the Southwestern Atlantic, particularly along the Argentine Continental Shelf, remain poorly understood. This work merges results from subsurface waters and surface sediments collected across the mouth of the estuary, inner and middle shelf, and beyond the shelf break. The data extend to the slope front and down to the 3000 m isobath. This approach provides the first multi-matrix assessment of MPs in the region. MPs were found at all 22 stations. Total MP concentrations in seawater were the highest on the inner shelf (9348.6 items/m^3). The middle shelf–shelf break had 6971.2 items/m^3, with the lowest in the Slope-Deep waters (3200.4 items/m^3). Significant differences were found among zones (ANOVA $p = 0.0118$). Fibers dominated (≥96%), with a few films and fragments present. There were also significant differences in particle colors ($p < 0.001$): red ones ($p = 0.0057$) decreased towards deeper waters, whereas black ($p < 0.0001$) increased offshore. Overall, Inner Shelf samples were dominated by Polyethylene (PE), Mid Shelf–Shelf Break by polypropylene (PP) and polycyclohexylenedimethylene terephthalate (PCT), and slope–deep waters showed a predominance of cotton-based polymers. In sediments, MP concentrations averaged 115–220 items kg^{-1}. Fibers were again predominant (>90%), and films were more frequent at the slope. We also detected MPs in the digestive tracts of two sea turtle species: Chelonia mydas and Dermochelys coriacea. These results revealed similar concentrations in both species, with 17.16 ± 12.72 items per individual in D. coriacea and 17 ± 28.82 items per individual in C. mydas. Fibers dominated all analyzed species (>94%). Building on these results, in my doctoral research will analyze how organochlorine pesticides, PCBs, PBDEs, and PFAS accumulate in sediments and elasmobranch fish. These compounds, which often attach to microplastics, may re-enter the water column and move through trophic networks. By adopting a One Health lens, the work connects environmental pollution with ecosystem and human-health implications across the Southwestern Atlantic.

13. Towards harmonized biomonitoring of MNPs in blood, challenges and capabilities
- Dorte Herzke

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Challenges in the application of analytical methods for MNPs to human samples, such as risk of sample contamination from the environment, lab equipment/disposables and interference from biological components, are limiting the reliability of MNP exposure assessments. Human biomonitoring of MNPs is reliant on ultra-trace and robust sampling, sample preparation, polymer characterisation and analytical methods using limited sample volumes. The North Atlantic Microplastic centre (NAMC) contributes to optimised, harmonized, and verified workflows for the reliable quantification of MNP in whole blood and plasma using mass based techniques. We aim to address MNP in blood following processing such as centrifugation for serum and/or plasma separation. Finally, we will evaluate the potential for using human plasma samples commonly stored in biobanks as well as blood donations to be used in MNP research. Expected findings will help refine current analytical methods in MNP measurement, which is foundational to future research evaluating MNP exposure and health effects. We target also include the analysis of plastic-related chemicals to provide a complete characterisation of human exposure. Our goal is ensuring the confident detection of circulating MNPs, applicable to a broad range of new and existing human samples in order to accurately quantify internal exposure. To achieve our goals, low-plastic sampling protocols for whole blood, and plasma, which avoid plastic consumables where possible, were designed and evaluated for background contamination using blanks throughout the complete sample collection and handling workflow. Whole blood and plasma samples will undergo clean-up using a peer-reviewed digestion protocols. Analytical techniques were optimised for the digested whole blood and plasma sample matrices, and method performance will be assessed. We will also compare the plastic content in blood samples with that in water samples, both collected using identical procedures, to distinguish between contamination sources and true exposure. The application of complementary analytical techniques (LC-MS/MS) will be implemented to maximize the chemical characterization of each blood fraction by enabling simultaneous detection and quantification of a broad spectrum of plastic-related species. This approach will improve sensitivity, selectivity, and confidence in distinguishing true exposure from background contamination.

14. Hyphenated analytical workflows for Characterising nanoplastics exposure from drinking water
- Haitao Lin

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Keywords: Nanoplastics; Pyrolysis-Gas Chromatography-Tandem Mass Spectrometry; Asymmetrical Flow Field-Flow Fractionation; Quantitative characterisation.

Nanoplastics (NPs, <1 µm) arise from the degradation of larger plastics or from intentional production. Increasing evidence shows that smaller particles can cross biological membranes and induce oxidative stress or inflammation, raising toxicological concerns. As drinking water is a critical exposure pathway, monitoring NP occurrence is particularly critical. However, NPs are difficult to detect and quantify due to their small size, weak analytical signals, and strong tendency to aggregate, which causes severe interferences. To address these challenges, this study aimed to develop a workflow combining Asymmetrical Flow Field-Flow Fractionation with Multi-Angle Light Scattering (AF4-MALS) and Pyrolysis-Gas Chromatography-Tandem Mass Spectrometry (Pyr-GC/MS) for NPs separation and polymer-specific identification. To enable coupling, acceptable method recovery rates are critical. For Pyr-GC/MS, using a mixed standard containing polystyrene (PS) and polymethyl methacrylate (PMMA) of approximately 500 nm, oven-concentration and freeze-drying methods were compared. Samples reduced and transferred to analysis cups with dichloromethane (DCM) yielded 60% recovery for polystyrene but only 6 to 10% for PMMA. For AF4 separation, preliminary tests with PS standards at 20, 80, 200, and 500 nm achieved accurate size assignment at 20 and 80 nm, whereas recovery deteriorated at larger sizes, leading to systematic undersizing. The use of 0.05% surfactant improved NP dispersion but did not yield sufficient recovery, indicating that further optimization is required. As DCM may dissolve or swell nanoplastics, which compromises the accuracy of AF4 particle size determination and fraction collection, ethanol was used instead as the solvent. A transfer method using six sequential rinses followed by collection on 0.3 µm glass fiber filter was evaluated using a mixed standard of 500 nm NPs including PS, PMMA, polypropylene, polyethylene, and nylon 66. The final workflow integrates preconcentration, AF4 fractionation with collection across discrete size bands, followed by polymer-specific identification by offline Pyr-GC/MS, employing mutually compatible solvents throughout. By addressing polymer and size dependent biases, the workflow scales NP quantification in water and yields size-resolved polymer data for exposure assessment.

15. Characterisation of virgin and recycled industrial plastics using pyrolysis with soft ionization coupled to high-resolution mass spectrometry and statistical analysis

- Michael Gray

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Adoption of recycled and reclaimed materials into different industrial applications is on the rise to meet sustainability strategies. For manufacturers to maintain value for use in high-performance applications there is a great need to characterise these complex recycled materials to ensure they are safe. This work describes an analytical workflow to characterise virgin and recycled industrial plastics (e.g. high-molecular-weight polyamide pellets and gears) using pyrolysis-atmospheric pressure gas chromatography coupled to a quadrupole time-of-flight mass spectrometry (py-APGC-QToF-MS). Tools utilised in the workflow include screening against a library to discover trends across samples, statistical analyses to understand the differences between the virgin and recycled materials, and structural elucidation tools to characterize those differences. Data was collected in full scan using the APGC system with a high-resolution mass spectrometer (Xevo G2-XS QTof). APGC offers an ionisation technique similar to atmospheric pressure chemical ionisation (APCI) and uses a corona discharge that produces softer ionisation. This results in possible molecular ion detection enabling confirmation of a molecular formula for identification. The sample data was first screened against a library of typical polyamide pyrolyzates to evaluate trends. Principal Component Analysis was then performed on the virgin plastic, the recycled plastic and the blanks which showed clear separation between the groups. Markers responsible for the differences were found using Orthogonal Projections to Latent Structures Discriminant Analysis. Markers that were up-regulated in either of sample types were selected from the S-Plot for further investigation. Because an MSE acquisition was employed, the accurate masses of both precursor and fragments ions were used for the interpretation of each marker and tentative identifications were made using an elucidation toolkit. N-vinylcaprolactam and 10-undecenetrile were identified in the recycled materials with a high number of fragment ion matches and a high i-FIT confidence level. These were subsequently confirmed against a reference standard. 10-undecenetrile was detected in the screening results as being unique to the recycled materials. Consequently, this data shows the benefits of employing APGC with high resolution mass spectrometry for characterising recycled plastics.

16. Developing methods for detecting novel halogenated microplastics for informing future risk assessment

- Ruvini Weerasinghe

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Halogenated high-performance fluoropolymers such as polytetrafluoroethylene (PTFE), polychlorotrifluoroethylene (PCTFE), exhibit significant chemical inertness and thermal stability. Their dense molecular arrangement makes them superior moisture barrier materials, widely used in medical and aerospace packaging. However, their manufacturing, use, and transformation via physical, chemical, and photochemical pathways release halogenated micro- and nanoplastics (MNPs), leading to potential human and environmental risks. Currently, there is inadequate information on the occurrence and fate of these polymers or understanding of any exposures, due to the lack of available methods. This study aims to develop Pyrolysis Gas Chromatography Mass Spectrometry (Py-GC-MS) method to accurately quantify PCTFE in a range of matrices. The single-shot mode of a multi-shot micro-furnace pyrolyser-PY-3030D (Frontier Lab Ltd. Fukushima, Japan), coupled with a GC-MS - GC2030 (Shimadzu Corporation, Japan), was used to develop methods to identify and quantify key pyrolytic markers. The pyrolytic behaviour of PCTFE in a mixed polymer matrix (simulating common blister pack formulations) was assessed by spiking PCTFE with polyvinyl chloride (PVC). Blank samples and controls of pure PCTFE and PVC standards were pyrolysed with each batch. Resulting pyrograms were compared to assess changes in abundance of PCTFE pyrolytic markers in PVC/PCTFE polymer mixtures. Pyrolysis of PCTFE produced three homologous series of tentatively identified structures (A, B, and C series containing Cl and F), ranging from dimers to hexamers. Signals of A and B series oligomers were suppressed in the presence of PVC up to a critical PVC:PCTFE ratio of 1:2, while series C oligomers showed both enhancement and suppression, depending on the individual product. Beyond this, the trend reversed as PVC ratios increased. Series A showed minimal interference and was reproducible throughout the experiment. These findings suggest that PVC affects the formation of the PCTFE pyrolysis products, impacting quantification and indicating the importance of appropriate pyrolytic marker selection. The reproducible and systematic response of series A in polymer mixtures emphasizes its robustness and suitability for accurate quantification of PCTFE in monitoring studies. The developed method offers a practical approach to assess PCTFE in complex environmental matrices, thus facilitating risk assessment and future policy decisions.

17. Assessment of microplastic contamination in Mtera and Hombolo dams in Dodoma region, Tanzania

- Zahra Musa Mazoya

Zahra Musa Mazoya[1]

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Micro plastics research is largely concentrated in Europe and North America, and is underrepresented in Africa. Despite the fact that the primary focus of micro plastic research has been in the marine environment, there has been increasing interest in determining the presence micro plastics in inland water systems. With a growing body of research on micro plastic pollution in Mtera and Hombolo Dams in the Dodoma Region of Tanzania remains limited. This study assessed the extent and characteristics of microplastic contamination in two significant freshwater dams in Tanzania: Mtera Dam and Hombolo Dam. The primary objective was to quantify microplastic levels and characterize their physical properties and likely origins across both locations, including spatial variations within sampling sites. Water samples were collected from multiple points in each dam and analyzed for microplastic presence. Descriptive statistical methods were employed to evaluate contamination levels, while visual inspection and counting categorized particles by color and forms. Additionally, microplastics were classified as either primary or secondary. The results revealed distinct microplastic contamination profiles between the two dams. Mtera Dam consistently exhibited higher microplastic levels, with a mean of 3.5 particles and greater variability (standard deviation 3.07) compared to Hombolo Dam, which showed a lower mean of 1.75 particles and less variability (standard deviation 1.753). In terms of characteristics, microplastic fibers were the predominant form in both Mtera (30 counts) and Hombolo (14 counts), black microplastics were the most abundant color in both dams (Mtera: 24 counts; Hombolo: 10 counts), although Mtera displayed a wider diversity of colors. Analysis of sources indicated that both dams were predominantly impacted by primary microplastics (Mtera: 79%; Hombolo: 93%). This study provides crucial baseline data on microplastic pollution in Tanzanian freshwater ecosystems. The findings underscore the need for targeted mitigation strategies that address both primary microplastic sources and the prevalent release of synthetic fibers.

Keywords: Microplastics, Freshwater Pollution, Mtera Dam, Hombolo Dam, Tanzania.

18. Chemical characterisation of particulate matter and airborne microplastics from inside 100 homes in West London

- Shane Fitzgerald

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Air in outdoor and indoor environments comprises a vast mixture of volatile, semi-volatile ((s)VOCs) and non-volatile organic compounds in the form of particulate matter (PMx – 10) and gaseous pollutants. Micro- and nanoplastics are sequestered in PM and have recently emerged as a potential risk factor for cardiovascular disease, neurological diseases, and inflammation. The average person spends over 90% of their time indoors and recent reports have suggested humans breathe up to 68,000 microplastic particles daily. However, little is known of their relative composition and abundances across homes relative to environmental and social factors, and in the context of (s)VOCs. In this study, deposition sampling followed by pyrolysis-gas chromatography mass spectrometry was used to estimate daily microplastic deposition loadings inside 100 homes across two seasonal campaigns. Chemical screening of (s)VOCs was also performed to understand the chemical composition of indoor fallout. Relationships with environmental and social variables were explored to determine potential pollutant sources. Particulate matter and black carbon reference samples were analysed to assess potential sources of matrix interferences. Chemical screening of the filters showed a wide variety of (s)VOCs across the homes and highlighted season-specific shifts in surface-bound chemical abundances. Significantly more deposited chemicals were detected in winter months highlighting the effect of colder temperatures on the fallout of chemicals from the air onto surfaces. Following both campaigns, polyethylene terephthalate (PET) and polystyrene (PS) were found to be the dominant polymers across the homes. Over the 28-day sample collection period, the median concentrations of deposited PET on the filters was 12.4 µg/m2 and 1.04 µg/m2 for PS. The mean concentrations across the homes were 23.7 µg/m2 for PET and 12.9 µg/m2 for PS, equating to 0.84 mg/m2 day and 0.46 mg/m2 day, respectively. The analysis of airborne microplastics is an emerging study area and there are currently no guideline concentrations recommended by environmental protection agencies with respect to public health. Nonetheless, this study provides an initial insight into the character and amount of airborne microplastics in the home as a proxy for inhalation and oral exposure.

19. A Chemistry-Informed Self-Supervised Neural Architecture for Robust Microplastic Spectral Analysis - Frithjof Herb

Frithjof Herb[1], Khay Fong[1]

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Characterising microplastics and their associated chemicals in biological matrices remains a major analytical challenge. Spectral data for environmental samples are inherently complex, high-dimensional, and often distorted by experimental or matrix effects, complicating accurate and robust automated identification and quantification. We present a chemistry-informed self-supervised neural architecture that leverages physical principles to enhance interpretability and robustness in spectral analysis. The model integrates circular harmonic based feature decomposition with a latent representation shaped by physicochemical constraints. Input spectra are expressed as real-valued harmonic components that preserve relationships among vibrational modes and peak interactions. This approach aligns the models domain comprehension with the underlying chemical information while being resilient to instrument dependant shifts and noise. Within our framework, the model reconstructs and classifies spectra through relationships grounded in chemical similarity rather than purely statistical proximity. This allows the system to learn compositional trends from largely unlabelled data, enabling compositional inference from largely unlabelled data. For example, with a single reference pair (such as neat polyethylene and polyethylene containing a known additive) the model can interpolate and even extrapolate additive concentrations, blend ratios, or degradation states with high fidelity. Despite its interpretive depth, the model is extremely lightweight. It operates with a fraction of the energy cost of conventional deep networks, producing less CO2 per hour of inference than the average person breathing would, assuming it is powered by an average coal-fired plant. Meanwhile it can process millions of spectra per second, freeing us up to better leverage our time and energy. This energy-aware design philosophy ensures accessibility and sustainability without compromising analytical performance. By embedding chemical and physical intuition directly into model design, this architecture offers an energy- and data- efficient interpretable tool. This is useful for mapping the compositional landscape of plastic pollution. It provides a foundation for more reliable detection, quantification, and characterisation of complex sample matrices like those of microplastics, advancing both analytical methodologies and supports the development of more comprehensive chemical inventories.

20. How good is our data? A perspective on current interlaboratory studies, EU-directives and guidelines, and the state – of - the – art in the research world on microplastics - Vilde Kloster Snekkevik

Vilde Kloster Snekkevik[1], Serena Ducoli[2], Thomas C. Meisel[3], Andrea Mario Giovannozzi[4], Stefania Federici[2,5], and IBert van Bavel[1]

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Reproducibility of micro- and nanoplastic measurement results across diverse matrices remains a significant scientific challenge. The combination of different measurement principles (FTIR, Raman, GC-MS, etc.) alongside variability in sample preparation procedures, instrumentation, software, and data interpretation result in significant measurement uncertainty and difficult-to-interpret data. Interlaboratory studies are pivotal for advancing methodological harmonisation, validating techniques, enhancing the comparability of results and providing insight into current practices. This study evaluates the alignment of current microplastic analytical practices with existing and upcoming legislation, directives and guidelines, identifying areas for improvement. Based on these findings, we propose strategies to ensure that current analytical approaches meet the requirements of the scientific community and reflect the latest advances in the field. Recommendations include designing 'fit-for-purpose' interlaboratory studies, employing realistic test materials and diverse polymer types, implementing multi-technique validation, and conducting recurring interlaboratory studies accessible to a broad range of laboratories and measurement principles. Furthermore, the development of sustainable support structures - such as targeted funding mechanisms and dedicated training hubs - is emphasised. By aligning the perspectives and capabilities of diverse stakeholders, this work aims to consolidate current practices and guide the development of more robust, inclusive, and standardised microplastic research. These efforts will help ensure analytical approaches are scientifically sound, policy-relevant, and capable of supporting global monitoring and regulatory frameworks.

21. Optimisation of Pyrolysis Gas Chromatography Mass spectrometry methodology for quantification of airborne microplastics – assessment of microplastic contribution to ambient PM10 and PM2.5 in urban environments

- Henry Blake

Henry Blake[1], Stephanie Wright[1], David Green[1]

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Microplastics are a form of anthropogenic pollution that can cause adverse effects both in vitro and in vivo at high concentrations. They have been identified in many different environments. An area of increasing concern is airborne microplastics; the contamination of the atmosphere acts both as a vector for transport of microplastics between environments and as a route for human exposure via inhalation To improve our understanding of the composition of airborne microplastics, particularly in the inhalable and respirable fractions, robust analytical techniques are required. Many standard methods for the identification of microplastics rely on microspectroscopy techniques and produce particle number counts. This work describes the optimisation of Pyrolysis Gas Chromatography Mass Spectrometry methodology for mass quantification of airborne microplastics, bringing it more in line with other regularly monitored airborne pollutants. Accurate quantification requires robust calibrations. For this work, both solid and liquid calibration mixtures were prepared and evaluated for consistency and used to enable quantification. Samples of ambient air were collected from four sites around London (UK) near suspected microplastic sources, along with a hypothesised low concentration background site. Both field blanks and procedural (laboratory) blanks were included to account for contamination during transport and storage. An internal standard was used to account for instrument variation. Pyrolysis Gas chromatography was found to be applicable to the identification of low concentrations of microplastics, achieving LODs <100 ng for many polymers. Preliminary results show that overall microplastics constitute ~1-2% of total particulate matter in both PM10 and PM2.5 size fractions. There is indication that polymer concentrations are elevated at the sampling sites compared to background levels. Comparison of the sites will show how the composition and concentration of microplastics varies between locations and are influenced by human activity in the area. This project represents another step forward in developing robust methodologies for airborne microplastics analysis and provides insight into the levels of microplastics in human health-relevant size fractions.

22. Smart Fine Particle Collector for micro and nano plastics analysis by Py-GCMS

- Karthikeyan Sathrugnan

Karthikeyan Sathrugnan[1], Atsushi Watanabe[1]

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Microplastics (MPs) is classified as an emerging contaminant, which has been receiving greater attention in the recent past. Studies have found microplastics in the environment (Air, Soil and Water) as well as in Food. It is evident that microplastics is making their way into our bodies too. Studies have found microplastics in human blood, urine etc. However, its impact on human health is not fully understood. Bioaccumulation of microplastics food chain is of great concern due to which even small concentration today can pose a threat in the future. Research efforts are ongoing to improve our understanding on microplastics detection, distribution and toxicological effects which are essential for federal agencies and policy makers to understand the issue and implement some measures. Accurate identification and quantification are primary steps in understanding and mitigating microplastics impacts. From recent research reports, it is evident that mass-based analysis should be an integral part of Microplastics analysis. In this work, we present newly developed filtration system to collect micro nano plastics from the water samples which allows to collect MP particles directly to Sample cup and minmize human errors from sample transferring process. In this talk, we will present working principle of the new filtration system and demonstrate performance validation based Recovery and precision through spiking of different known MP particles of different types and sizes. The same collection device can be used for final collection of MP particles from other matrices such as Sediment, biological samples, biota etc. These details will be presented during the presentation.

23. Microbial degradation of microplastics in wastewater treatment
- Karla Heric

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Microplastics (plastics < 5 mm) are ubiquitous. They can affect ecosystems and threaten both human and animal health. Microplastics and more commonly, microfibres, enter wastewater streams from human lead activities such as the laundering of synthetic clothing and the breakdown of plastics. Increasing evidence shows that wastewater treatment is relatively efficient at removing microplastics from wastewater, concentrating them in biosolids, a wastewater treatment by-product composed of organic material, microbes, and inorganic compounds. In Australia, biosolids are used as a nutrient-rich fertiliser but can introduce microplastics into terrestrial environments. Microbial degradation has been proposed as a method of removing microplastics from wastewater streams to prevent environmental dispersal. This body of work explores the feasibility of microplastic microbial degradation in biosolids through applying techniques such as 16S rRNA gene metabarcoding to study biosolids microbes and Fourier Transform infrared spectroscopy (FTIR) coupled with microscopy for the analysis of biosolids microplastics. The results showed that microplastics isolated from municipal wastewater treatment biosolids consisted mostly of polypropylene with the dominant type of microplastics fragments and a most prevalent site range of particles between 20 and 100 µm. Additionally, plastic-degrading microbial genera are present in biosolids, with Clostridium present in highest relative abundance amongst plastic-degrading genera. This study begins to assess plastic microbial degradation in a wastewater treatment setting.

24. Fragmentation and Ageing of Secondary Microplastics: Implications for Microbial Attachment and Human Health Risk
- Stephanie Northen

Stephanie Northen[1], Fay Couceiro[2], Alex Ford[2], Sophie Leterme[3]

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Plastic pollution and climate change are increasingly recognised as interconnected threats to environmental and public health. Our study investigates the fragmentation dynamics of secondary microplastics in marine environments, focusing on how different polymer types degrade under simulated weathering conditions. Using mesocosm experiments to control changing marine stressors, we apply analytical techniques to quantify changes in surface morphology and fragmentation rates across weathering stages. We focus on polymers widely used in single-use packaging - polyethylene terephthalate (PET), low-density polyethylene (LDPE) and polypropylene (PP) - due to their prevalence in coastal waste and potential to fragment into microplastics under intensive stressors such as UV and freeze-thaw conditions. Analytical techniques include Scanning Electron Microscopy (SEM), Raman Spectroscopy, Optical Profilometry (surface roughness) and mechanical testing (tensile and impact strength). These physical transformations are evaluated for their influence on microbial colonisation, with emphasis on the attachment of marine pathogens such as Escherichia coli and Vibrio spp., commonly released via untreated sewage or overspills into coastal waters of the UK. We explore whether aged microplastics provide preferential surfaces for pathogen adherence, potentially acting as vectors for disease and microbial transport. This mechanism may elevate exposure risks of disease for marine organisms and humans through food chains and environmental contact. The findings contribute to understanding how microplastic ageing influences pathogen dynamics, informing future risk assessments and mitigation strategies under changing climate conditions. By elucidating the role of aged microplastics in pathogen transport, this study provides a scientific basis for policy development, coastal intervention planning, and industry guidance on safer polymer design and end-of-life plastic management.

25. Towards a Unified Plastic–Biodiversity Baseline for Small Island Developing States
- Amardeep Wander and Shubha Singh

Amardeep Wander[1], Shubha Singh[2], Anete Berzina[3]

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Marine plastic pollution poses a mounting threat to biodiversity and coastal livelihoods, particularly in Small Island Developing States. This project establishes the first harmonised baseline connecting plastic flows with biodiversity status in priority ecosystems (two locations) across Samoa, Tonga, and Vanuatu. Interdisciplinary protocols were developed to map plastic leakage alongside key biodiversity areas and satellite/drone data, while also overlaying spatial, economic, and ecological values. Participatory approaches enabled data collection in 2025, including product hot-spotting, brand audits, and material flow analysis—combined with local biodiversity and ecosystem assessments. Early results indicate that lightweight packaging and mismanaged single-use plastics are principal drivers of both ecological risk and economic impact, with tourism and fisheries particularly affected. Baseline findings informed the production of an integrated toolkit to guide management at local scales—incorporating environmental, societal, and economic indicators. The work supports evidence-based development of action plans, stakeholder engagement, and reporting on progress towards circular economy goals and SDG 14. By uniting biodiversity expertise and plastics science, this collaborative baseline enables governments, businesses, and communities to plan science-based interventions, build resilient ecosystems, and effectively monitor the outcomes of plastics reduction efforts within high-biodiversity coastal areas.

26. Can Topography Control Plastic Degradation Rates? Analysing Polymer Degradation Pathways and Environmental Uptake Leading to Human Exposure
- Eleanor Mullen

Eleanor Mullen[1], Bronwyn Laycock[1], Steven Pratt[1] and Paul Lant[1]

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The surface topography of plastics strongly influences microbial adhesion and biofilm formation. Techniques such as laser patterning or plasma etching can be used to alter polymer surface topography. Engineered topographies can mimic natural antifouling and microbicidal structures such as lotus leaves and cicada wings. A governing factor of plastic stability and environmental degradation rates, topography can directly impact human exposure. In the case of food packaging applications, poor surface design may compromise food packaging integrity, increasing human exposure to plastic associated chemicals. Despite this, few studies quantitatively assess how surface topography can be used to govern bacterial colonisation and the subsequent rate of polymer degradation. This research addresses this gap by designing and testing surface topographies to modulate degradation rates of bioplastics. Analytical approaches to monitor bacterial colonization and surface erosion such as SEM, AFM, and confocal microscopy are detailed. Identifying how topography can impact environmental persistence, and hence human exposure, aids in improving Safe and Sustainable by Design (SSbD) product manufacture. This work informs future analytics for polymer degradation pathways in biological and environmental samples.

27. Vertical Migration of Microplastics in Soils Amended with Composted Municipal Solid Waste
- Nivetha Sivarajah

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Composted municipal solid waste (MSW) may be used as a soil improver in agriculture and land rehabilitation settings. The presence of microplastics (MPs), however, has limited its application due to concerns about soil health and food security, although the extent and movement of MPs in different soil types and in different applications remain poorly defined. This study investigated the movement of MPs sourced from composted MSW in three soil types (silty loam, sandy loam and clay) with varying organic matter content in a controlled glasshouse column experiment. The composted MSW was surface applied and incorporated to 15 cm at 50 t/ha and the columns (0.85 m length x 0.15 m internal diameter) were watered regularly to 60% field capacity. Soil samples were collected at 12 and 18 months from different soil depth intervals up to 50 cm down profile. The MPs were extracted using digestion (30% H2O2) and density separation (ZnCl2), then quantified and characterised by Stereoscopic Zoom Microscope. The MPs migration varied significantly with soil type and application method. Surface application resulted in 60-90% (372 MPs) of MPs retention at the 0-5 cm depth in sandy loam soil after 18 months. In contrast, incorporated treatments resulted in a more even distribution to 15 cm, with 30-40% of MPs in the 0-5cm layer and 5-35% in the 5-10 cm layer. Clay soils exhibited the strongest retention (e.g. 89% in the upper 10 cm for surface treatments). Movement below 15 cm was evident, but only 1-17 MPs were detected below 15 cm depth across all application methods. Temporal analysis indicated limited additional MP migration between 12 and 18 months, with <1% of MPs detected below 45 cm in any treatment. Fibres accounted for 52-60% of MPs in surface treatments and 36-48% in incorporated treatments. Fibres exhibited greater depth penetration, comprising 100% of MPs at 45-50cm in sandy loam surface treatments. The size fraction 0.1-1 mm was the most abundant size, comprising 44-55% of MPs across all treatments and at soil depth. Overall, the findings demonstrate that MP migration down profile depends on soil type but smaller particles may show substantial movement in well drained soils. This raises concerns for soil health, water body pollution and off-site impacts when using composted waste materials. Keywords: Microplastics, Vertical movement, Soil column, Compost Application.

28. Validation of a method for identification and quantification of bisphenols and phthalate metabolites in post-mortem human brain

- Ian Zammit

Ian Zammit[1,2], Ayomi Jayarathne[1,2], Emerson Aldridge[1,2], Julia Lin[1,2], Geoff Eagleham[1,2], Timothy A. Couttas[3], Eurwin Suryana[3], Claire E. Shepherd[3], Jochen Mueller[1,2], Xianyu Wang[1,2]

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Plastic-associated chemicals, such as bisphenols (BPs) and phthalate esters (PAEs), are widely used in consumer products and have been associated with negative health outcomes including hormonal effects and neurobehavioral differences. Though human biomonitoring studies have demonstrated widespread exposure, little is known about the bioavailability or accumulation of these chemicals in the brain. This work presents a validated analytical method for the quantification of 14 phthalate metabolites and 7 bisphenols in post-mortem human brain tissue. Developed using goat brain tissue, our method employed a modified QuEChERS extraction protocol, incorporating hexane clean-up to reduce lipid interference. Separate LC-MS/MS methods were subsequently developed for BPs and PAEm, achieving method detection limits (MDLs) ranging from 0.02 ng/g to 0.8 ng/g for phthalate metabolites and 0.02 ng/g to 2 ng/g for bisphenols. Application of the method to ten post-mortem human brains revealed levels of several analytes at around MDL threshold levels. This method provides a robust platform for investigating the presence of plastic-associated chemicals in brain tissue and supports future research into their potential neurotoxic effects and blood-brain barrier permeability.

29. Linking River Microplastics with Plastic Waste Sources: A Case Study from the Perai River, Malaysia

- Leila Bouida

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Microplastic contamination in freshwater systems causes a rising threats to environmental and human health, particularly in rivers that supply domestic and industrial water. As they act as a pathway for land based plastics to reach the seas. The Perai River in Penang, Malaysia, is a vital freshwater source for local communities but is under increasing anthropogenic pressure while being considered for future potable use. This study investigated microplastics in water and sediment during the dry and wet season, corresponding to the Southwest and Northeast monsoons, respectively. Water and sediment samples from eight stations were processed for microplastics isolation and characterised by morphology, size, colour, and polymer composition using ATR-FTIR and SEM-EDX analyses. Dry season results revealed that water samples were dominated by fibres (65%), mainly <300 µm (63%), composed of LDPE and EPDM, and mostly black and grey in colour. Sediment samples contained 49% fibres, with 90% of them <300 µm is size, predominantly LDPE and EPDM polymer types, mainly in black color. Higher microplastics abundance was recorded upstream nearby an ongoing construction area. Wet season samples are still being processed, and results will be presented at the symposium to assess monsoon driven variations. Complementary plastic waste audits conducted during river cleanup campaigns 2025, revealed that plastics constituted 64–89% of total collected waste, ranging from 31 kg to 122 kg per event. PET, HDPE, LDPE, PP, and PS were dominant polymers, with non-recyclable items (food wrappers, cups, straws) comprising about 75%. This integrated micro and macroplastic assessment provides the first baseline for the Perai River and emphasizes the importance of linking microplastic monitoring with macroplastic source identification to support sustainable river management.

30. Measuring nano- and microplastics: what can we detect and how?

- Åsa Jämting

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The interest and awareness of nano and microplastics in water and more complex matrices is increasing and many international bodies (regulatory, standardization, consumer groups) are interested in improved methodologies and detection limitations to aid in their decision making. The development of standardised methods and guidelines for testing the presence, as well as properties of these particles is also of increasing importance, to generate comparable and reliable results. Common questions that arise for these particles are: what is the size, shape, concentration and identity of the entities we are trying to measure; how much is detected versus present; is the measurement technique we are using capable of measuring the properties we are interested in; is there a suitable test method available; what are the associated risks and/or regulations; and who do we talk to about our results? Here, some of the challenges from a metrological point of view are discussed and evaluated, in the light of available and proposed instrumentation.

31. DashMP: Deep learning automated spectral high-throughput microplastic analysis

- Junli Xu

Junhao Xie, Aoife Gowen, and Jun-Li Xu[1]

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Microplastics (MPs) are widespread and persistent environmental pollutants that pose potential health and ecological risks. Effective monitoring of MPs in the environment is therefore essential for assessing and managing MP pollution. In this work, we present DashMP, a software tool designed for high-throughput and accurate spectral classification of MPs. The core of DashMP is a convolutional neural network (CNN) that automatically extracts spectral features, thereby minimizing the need for manual preprocessing. To accommodate spectra of varying ranges, we developed a variable-length data augmentation strategy, a capability not supported by existing CNN-based MP spectral classifiers. Recognizing that MP identification in real-world environments represents an open-set problem, DashMP integrates both an uncertainty thresholding approach and the OpenMax algorithm to reject unknown classes. Within the optimal uncertainty threshold range of 0.87 ± 0.01, the model achieved 93.1% accuracy on both the known-class test set (15,741 spectra) and the unknown-class test set (6,279 spectra), demonstrating excellent performance and open-set robustness. Beyond model accuracy, DashMP offers a suite of user-oriented features, including spectral visualization, statistical summaries, and result export functions. It also supports batch inference and integration with hyperspectral imaging workflows, enabling the processing of large spectral datasets, a feature not available in existing CNN-based MP classifiers. Leveraging high-performance GPUs, DashMP can perform inference on five million spectra per second (excluding output operations), providing a scalable and practical solution for automated, high-speed MP monitoring in environmental applications.

32. Microplastics in Human Aqueous and Vitreous Humour and Bisphenols in Serum: A Pilot Detection Study

- Tanja Bogdanović

Tanja Bogdanović[1], Silvio Špičić[2], Zoran Vatavuk[3], Goran Marić[3], Zvonimir Jažo[1], Sandra Petričević[1], Eddy Listeš[1], Federica DI Giacinto[4], Irena Listeš[1]

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To address concerns about the effects of MPs and BPs on human eye health and blood serum, it is important to use optimised methods for their detection and characterisation. To diagnose eye health problems and the possible presence of xenobiotic MPs, GC-MS pyrolysis in human aqueous humour (AH) and vitreous humour (VH) has been successfully used to detect 11 microplastic polymer clusters. The potential MPs isolated from human ocular compartments were qualitatively characterised by stereomicroscopy. The number of potential MPs ranged from 14 to 69 no./g in AH and from 21 to 34 no./g in VH. A strategy based on dansyl chloride derivatisation combined with in-source fragmentation by mass spectrometry was used to screen for 5 BPs in the blood serum of the same patients whose AH and VH were selected for microplastic detection. Results obtained from the analysis of 13 human blood serum samples indicate that some of the individuals examined are exposed to BPA (in the range of 3.90–5.63 ng/ml) and its analogue BPAF (in the range of 2.13–4.54 ng/ml). The most prominent polymer clusters detected in the AH samples were C-PMMA, C-PVC, C-PET and C-PP, with average levels of 0.82 ± 0.32 µg/g, 0.41 ± 0.82 µg/g, 0.48 ± 0.70 µg/g and 0.41 ± 0.82 µg/g, respectively. The three VH samples contained only C-PMMA, with an average level of 0.55 ± 0.12 µg/g. Additionally, C-PA66 (0.30 ± 0.21 µg/g) and C-PA6 (0.15 ± 0.44 µg/g) were occasionally detected in AH samples.

33. Smaller Plastics, Bigger Risks, How Sub-micron IR (O-PTIR) Reveals the Invisible Threat of Nanoplastics and Microplastics

- Mustafa Kansiz

Mustafa Kansiz[1], Eoghan Dillon[1]

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Microplastic (MP) contamination has become a global environmental and health concern, with particles now detected in water, air, soil, and biological systems. These particles can enter the human body through ingestion or inhalation, where submicron MPs and nanoplastics (<1 µm) are of particular concern due to their ability to cross biological barriers and accumulate in tissues.

Infrared (FTIR/QCL) and Raman spectroscopy are the most common tools for MP analysis, yet both face major challenges at small particle sizes. Conventional FTIR is generally limited to >20 µm due to diffraction and suffers scattering artefacts, affecting spectral reproducibility, while Raman offers higher spatial resolution (<10 µm) but suffers from fluorescence interference, poor sensitivity, and frequent misidentification of long-chain molecules, like stearates, as polymers like polyethylene. These limitations leave a critical gap in characterizing submicron plastics—the size range most relevant to biological uptake and toxicity.

Optical Photothermal Infrared (O-PTIR) spectroscopy overcomes these constraints by delivering true submicron infrared spatial resolution (<500 nm) in an optical microscope format. Operating in reflection mode, O-PTIR provides FTIR transmission/ATR-like spectral quality without contact or scattering artefacts and is unaffected by fluorescence or dark/coloured samples. Furthermore, its multimodal capability enables simultaneous, same-spot, same-time, same-resolution Raman measurements for complementary chemical information.

We have developed automated workflows for detecting and chemically characterizing micron and submicron MP particles using O-PTIR and Raman. Samples can be screened optically or via fluorescence imaging to locate particles of interest, which are then automatically measured for both IR and Raman spectra. This approach achieves accurate polymer identification on particles far below the limits of conventional infrared microscopy, enabling high-confidence analysis of environmental and biological samples.

This presentation will introduce O-PTIR technology, outline its operating principles, and demonstrate its application for automated MP measurement and mapping. Real-world case studies will illustrate how O-PTIR enables the detection, identification, and spatial distribution mapping of micro- and nanoplastics in a range of samples from waters, to tissues and cells—revealing what has long been invisible to conventional vibrational spectroscopy.

34. Certified Reference Materials for Nanoplastics and Tire Wear Particles: Enabling Reliable Exposure Assessment

- Elisabeth Rødland

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Understanding the influence of microplastic particles (MP), nanoplastics (NP), and tire-road wear particles (TRWP) on organisms, including humans, requires accurate exposure data. These particles are increasingly detected in air, water, and food, raising concerns about ingestion and inhalation. Yet, the potential health impacts of chronic exposure remain largely unknown, particularly for NPs and TRWPs, which may cross biological barriers and interact with tissues at the cellular level. Reliable exposure assessment depends on analytical methods capable of identifying and quantifying MPs, NPs, and TRWPs across size classes, but current mass-based techniques such as pyrolysis-GC/MS lack standardized reference materials for validation and comparability.

35. Light- and Mechanically Activated Catalysis for Microplastic Degradation in Water
- Andrea Veciana

Andrea Veciana[1,2], Chiara Canovi[2,3,4], Nicoly Milhardo Lourenço Nohara[3,4], Salvador Pane i Vidal[2], Erika Iveth Cedillo-González[3,4]

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The prevalent presence of plastic debris in aquatic environments represents an emerging concern for human health, as environmental degradation processes generate micro- and nanoplastics, release of additives, and transformation products that can enter drinking water, food chains, and air. Developing strategies that accelerate the breakdown of plastics or enable the recovery of valuable organic products is therefore of increasing interest in research.

In this work, we investigate novel degradation pathways for microplastics, focusing on polystyrene (PS) and low-density polyethylene (LDPE), using ceramic nanocatalysts capable of generating highly reactive chemical species that attack and break polymer chains. These materials exploit photocatalysis, where light irradiation activates the catalyst to produce reactive oxygen species, and piezocatalysis, where mechanical stimulation such as ultrasonic vibration induces electrical charges within the catalyst that further enhance reactive species formation. The combination of light and mechanical energy enables more efficient polymer degradation under conditions relevant to natural aquatic environments.

We demonstrate that light-activated ceramic catalysts can induce PS nanoplastic degradation in hydrated systems. Under irradiation, reactive oxygen species initiate polymer chain scission, leading to surface erosion, deformation, and chemical oxidation of PS particles. These transformations were confirmed by infrared spectroscopy, which revealed the formation of oxygen-containing functional groups, alongside macroscopic changes in surface properties and dispersion behavior. Notably, turbidity measurements showed a clear decrease after 12 hours of photocatalytic treatment, indicating particle breakdown and transformation, while water contact angle measurements decreased from approximately 85° to near zero, reflecting increased surface oxidation and hydrophilicity.

Building on these findings, ongoing work extends this approach to LDPE microplastics, where the combined use of light exposure and mechanical stimulation is employed to investigate how piezoelectric ceramic catalysts enhance degradation. The results indicate a synergistic effect between photocatalytic and piezocatalytic processes, leading to accelerated microplastic transformation compared to individual stimuli alone.

36. Tracing micro- and nanoplastics in food: The role of packaging
- Lisa Zimmermann

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Micro- and nanoplastics (MNPs) have been detected in various foods and beverages, leading to widespread human exposure. Research implies that such exposure negatively impacts human health. If the main sources of these MNPs were identified, targeted interventions could inform mitigation measures that reduce MNP exposure. However, current focus on exposure is primarily on environmental contamination as the source of MNPs in food and beverages, while the role of plastic food packaging and other plastic food contact articles (FCAs), such as processing and transport equipment, as direct MNP sources in foodstuffs remains largely overlooked. To address this gap, we systematically mapped the scientific evidence of MNPs present in foodstuffs originating from the normal and intended use of FCAs, such as bottle opening and tea brewing. Importantly, we also critically appraised the robustness of the reported data and the strength of the evidence linking FCAs to MNP contamination in food. We identified 103 studies that met our eligibility criteria, resulting in 600 database entries, which are accessible and can be filtered in the FCMiNo dashboard. Over 95% of these entries reported the presence of MNP in analyzed foods, beverages, and food simulants. However, our critical appraisal shows that the overall quality of these studies is poor (i.e., the data are often unreliable) and that the study design is mostly irrelevant for establishing a causal link between the FCA and the MNPs in food. Only seven studies (7%) were deemed highly reliable and relevant. These studies indicate that plastic FCAs can release MNPs into foodstuffs under intended or foreseeable conditions of use. Our findings underscore the need for further research to quantify the extent of FCA-related MNP contamination and to determine whether specific products, polymer types, or use scenarios are more prone to releasing MNPs. They also highlight the importance of standardized testing and reporting methods to enhance data reliability and comparability. We recommend incorporating MNP migration testing into FCA regulations to reduce exposure and promote more sustainable food systems. Our systematic evidence map includes scientific literature published up to December 2022. Since then, MNP research has rapidly expanded. Therefore, we are currently working on an update and plan to share preliminary insights from the new data at the Plastics2026 symposium.

37. Nonylphenol exposure in an Australian population using urinary biomarker analysis
- Danielle E. Que

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Nonylphenol is an alkylphenol primarily used as a precursor of nonylphenol ethoxylates (NPEO) and tris(4-nonylphenyl) phosphite (TNPP), which are widely used as additives in industrial and consumer products. The breakdown of NPEO and TNPP to NP contributes to its widespread occurrence in environmental and human matrices. Exposure to NP and its derivatives has posed concerns due to their endocrine disrupting properties and association with other toxic effects. A contaminant-free approach in quantifying NP exposure in urine based on the specific oxidised NP metabolites, OH-NP and oxo-NP, has been successfully applied in pooled urine samples collected from 2014–2015 and 2022–2023. These samples were pooled and stratified by age and sex, resulting in 48 pools representing 4,800 individuals. This study provides the first evidence of NP exposure in an Australian population and an in-depth investigation of the age-, sex- and temporal-related trends/differences in exposure. Reverse dosimetry was performed to conduct exposure and risk assessment. OH-NP, the major urinary NP metabolite, was detected in all pools. OH-NP urinary levels and calculated daily intakes (DIs) were four times lower in 2022/23 than in 2014/15. Decreasing exposure with age was observed in females whereas it remained relatively stable across age groups in males. Male and female children had similar exposure levels while more pronounced sex-related differences were observed in adults. Males had higher intakes than females when all ages were combined. Overall, NP exposure in Australia has decreased in the recent years which may be attributed to restrictions on NP use. Based on the DI values calculated from the pooled samples in this study, average population NP exposures remain within the established safety limits.

38. Car tire particles and their additives: biomarkers for recent exposure and implications for the human exposome

- Dorte Herzke

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Every year, 1.7 billion new vehicle tires are produced world-wide. During its active use, an average car tire loses about 1.5 kg in mass, forming millions of tire wear particles (TWPs), which become part of the inhalable air pollution in urban areas and close to highways. In addition to TWPs, crumb rubber produced from end-of-life tires has been used as infill on artificial grass on outdoor sport pitches, where it has become a popular low-cost substitute for natural grass, sand, or gravel, but is prone to runoff and additive chemical leaching into the surrounding environment, as well as being an additional exposure route to humans. The magnitude of emissions and their complex composition, which includes rubber polymers, chemical additives, and their derivatives make these particles problematic, with soils, waterways, and eventually coastal and marine systems acting as the main environmental sink compartments. Here, both rubber particles and their leachates, may induce toxic effects across a range of exposed habitats, species, and functional groups, entering the wide food chain. In urbanized areas, TWPs are emitted from roads, and granulates disperse from artificial sports fields and other urban surfaces to the environment, suggesting that runoff to coastal systems is likely and a route of exposure to marine organisms. The current study investigated the presence of TWP related chemicals in relevant environmental samples such as urban air, road runoff, snow, sediments and marine organisms to improve our knowledge of the potential pathways for human exposure beyond particle inhalation. In addition, exposure experiments in blue mussels, a commonly consumed seafood species, were conducted to better understand the uptake kinetics of TWP chemicals. Findings from both studies confirm the predominant influence of tire-derived chemicals in car tire–affected environments and their uptake by marine organisms, such as blue mussels. Furthermore, when tire particles are no longer present, associated chemicals exhibit longer persistence within blue mussels, leading to the formation of transformation products that are more persistent than their well-known parent compounds (e.g., diphenylguanidine and 6-PPD), potentially useful bioindicators for TWP exposure as well as following up their little understood implications for human health.

39. Metabolites of phthalate and non-phthalate plasticizers in Australian pooled urine samples from 2020–2021

- Yarui Liu

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Phthalate plasticizers (PAEs) have been widely used in various consumer products. Due to their toxicological effects and endocrine-disrupting properties, non-phthalate plasticizers (NPAEs) have been developed and commercialized. Their widespread presence in the environment has prompted scrutiny possible human exposure and concerning potential health risks. The aim of this study was to provide the assessment of exposure to PAEs and NPAEs in the Australian population. Thirty-five metabolites of PAEs (mPAEs) and fifteen metabolites of NPAEs (mNPAEs) were measured in pooled, de-identified surplus pathology urine samples collected cross-sectionally between 2020 and 2021 from an Australian population (4,800 individuals represented by 48 pools). Age and sex trends have been assessed for mPAEs and mNPAEs detected in ≥ 75% of pools. MEP (mean: 146 ng/mL) and 5cx-MEPTP (mean: 60 ng/mL) were predominant mPAE and mNPAE, respectively. Higher urinary concentrations of MBzP, MEHHP, and MEOHP were observed in male than female in both children (< 15 years old) and adults (≥ 15 years old), while significant sex differences in MiBP, MCPP, 4cx-MnBP, 5cx-MnPeP, MEHP, MECPP, OH-MiNP, oxo-MiNP, OH-MiDP, oxo-MiDP, cx-MiDP, 5OH-MEHTP, 5oxo-MEHTP, OH-MINCH, cx-MINCH were observed only in adults (≥ 15 years old). Negatively associations were observed between age and urinary concentrations of 2OH-MiBP, MnBP, 3OH-MnBP, 4cx-MnBP, 5cx-MnPeP, MEHHP, MEOHP, MECPP, cx-MiDP, 5cx-MEPTP, 5OH-MEHTP, OH-MINCH, oxo-MINCH, cx-MINCH, and 3cx-MnPrP. However, urinary concentration of MEP was positively associated with age in both male and female. DnBA contributed to 53% of the total estimated daily intakes for all plasticizers, followed by DEHTP (23%). This study highlights age and sex trends in the exposure of PAEs and NPAEs in Australia.

40. Characterisation of antibodies against plastic-derived chemicals and immunoreactivity in human brain tissue

- Tim Couttas/Quoc (Jeremy) P Tran

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There is growing concern around the application of plasticisers, particularly bisphenol A (BPA) and phthalates, and their contribution toward neurological dysfunction. As endocrine disruptors, these chemicals have been implicated in altered neurodevelopment, with recent discoveries of these chemicals in human brain tissue having heightened concern around their potential neurodegenerative impact. In this study, we validated bespoke antibodies against monobutyl phthalate (MBP), dibutyl phthalate (DBP), and bisphenol A (BPA) for immunohistochemical detection in human brain tissue. Antibody specificity was optimised through systematic refinement of tissue preparation, section thickness, and antigen retrieval protocols. To assess cross reactivity, antibodies were validated against structurally homologous endogenous compounds before application against temporal cortex sections from AD patients to resolve their localisation. Anti-DBP demonstrated robust immunopositivity within AD pathological hallmarks, with quantification revealing that approximately 70% of amyloid-beta plaques (n=10) exhibited DBP staining. Anti-DBP immunoreactivity was also identified within neurofibrillary tangles based on morphological criteria, and in glial cells. Similarly, anti-BPA immunopositivity co-localised with neurofibrillary tangles, amyloid plaques, and glia. Anti-MBP demonstrated increased glial positivity in AD tissue compared to controls. These findings indicate that the anti-MBP, DBP and BPA antibodies are highly specific for their target compounds. Although the antibodies demonstrated cross-reactivity to chemically similar compounds, including endogenous molecules in human brain tissue, this occurred at concentrations outside of the physiologically relevant range. Importantly, immunohistochemical analysis revealed that the pathological hallmarks of AD are immunoreactive against anti-DBP and BPA. Confirmation using orthogonal techniques, such as mass spectrometry, is necessary to validate the presence and concentration of these chemicals.

41. Does the Presence of Chlorinated Paraffins in Plastic Fruit Stickers Adhesive Pose a Threat to Human Health?

- Chang He

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Chlorinated paraffins (CPs) are high-production chemicals widely used in adhesives due to their superior adhesion properties. While the environmental and human health risks of CPs are increasingly recognized, little attention has been paid to their presence in food-contact materials such as fruit stickers. This study represents the first investigation into CP contamination in fruit stickers and their potential contribution to human dietary exposure. The ∑CPs concentrations ranged between 36 and 150 ng/sticker, with the highest contribution from long chain CPs (LCCPs). Specifically, Cl1–2 congeners contributed most to ∑CPs, resulting in low chlorine content in the fruit stickers, i.e. 33%±5%, 25%±3%, and 16%±2%, for SCCPs, MCCPs, and LCCPs, respectively, contrasting technical CP mixtures typically dominated by Cl4–8 congeners. Preliminary tests suggested potential transfer of CPs from stickers to fruits, with an estimated 29% transfer rate. The average human intake of CPs via fruit sticker residues was estimated at 4.5 ng/day, with a worst-case scenario of 83 ng/day. These exposure levels are lower than those from other pathways, such as dust ingestion, but emphasize the need to regulate CP use in food-contact materials. However, these findings should be well interpreted with caution due to the limited number of samples analyzed.

42. Harmonised Analysis of Airborne Microplastics: Results from the Plastic Dust Cloud Project

- Julia Jaeger

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INTRODUCTION: Airborne microplastics (MP) are emerging as an environmental and health concern. Despite growing evidence of their global presence, progress is hindered by inconsistent methodologies and the absence of harmonized QA/QC protocols for sampling, preparation, and analysis. This study applied a unified approach to globally collected air samples, enabling comparable data generation and highlighting the relevance of atmospheric MP pollution. METHODS: Samples were collected using a standardized wet–dry deposition method from 12 locations across 9 countries on 3 continents between June and August 2024. At each site, multiple samples were collected to allow analysis with both spectroscopic (Raman, FTIR, LDIR) and thermoanalytical (TD-GC/MS, PYR-GC/MS) technologies for every sampling site. Stringent QA/QC measures were implemented throughout the study. RESULTS AND DISCUSSION: MPs were detected in all samples. Deposition rates of MPs varied by location and detection method, ranging from 1,250 particles m^{-2} day^{-1} in Barneveld, the Netherlands by LDIR to 3,110 µg m^{-2} day^{-1} in Bergen, Norway by PYR-GC-MS, measured using vibrational spectroscopy and thermoanalytical techniques, respectively. Polymer composition also differed between sites, with polyethylene and polypropylene being the most commonly detected types. Most particles were smaller than 100 µm, making them small enough to be inhaled by humans. Results revealed notable variations in deposition rates between adjacent sample points analysed with the same detection technology, highlighting the heterogeneity of airborne MPs and the complexity of accurately measuring them. Overall, these findings underscore the urgent need for standardised global protocols to monitor airborne MPs effectively. CONCLUSIONS: This study demonstrates that airborne MPs are ubiquitous, with deposition rates and polymer composition varying across locations and detection methods. The prevalence of small, respirable particles and the heterogeneity observed between adjacent sampling points highlight the complexity of accurately assessing airborne MPs. Importantly, no single analytical technique is sufficient for all purposes, emphasizing the need for careful method selection. Collectively, these findings underscore the urgent requirement for standardized global monitoring protocols to better understand and manage the risks posed by airborne MPs.

43. Promoting safe sanitary products for young consumers: Assessing potential chemical risks in menstrual cups

- Andy Booth

Andy Booth[1], Amaia Igartua[1], Marianne Molid[1], Elisabeth Maria Fugger[1]

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Reusable menstrual cups are increasingly popular among young women as alternatives to disposable menstrual products. However, the rise in international online shopping has made it easier to purchase uncertified menstrual cups that may contain harmful chemicals or metals. In Norway, menstrual cups are classified as medical devices under EU Regulation 2017/745 and must be CE-marked to ensure compliance with health and safety standards. Despite this, many consumers unknowingly purchase non-compliant products online, raising concerns about chemical exposure and product safety. This issue is particularly relevant for young women, who may be less risk-averse and more inclined to choose cheaper, uncertified products. Studies suggest that this demographic is more susceptible to online shopping and price-driven decisions, which may increase the likelihood of purchasing products containing potentially harmful substances. The combination of increased interest in reusable products and the accessibility of international online marketplaces creates a pressing need for reliable safety information. Here, we investigate the chemical composition and leaching potential of different menstrual cups available on the Norwegian market, including uncertified products purchased from international sources. Through detailed chemical analyses of the bulk material by pyrolysis GC-MS and GC-MS characterization of the chemicals leaching into synthetic biological fluids, we assess the presence and migration of potentially harmful substances. Our findings will be disseminated through targeted communication channels designed to reach young women, ensuring they have access to reliable information that supports informed and safe product choices. By combining analytical data with strategic outreach, this project contributes to consumer protection and public health by promoting awareness of chemical safety in reusable menstrual products.

44. Micro-nanoplastics penetration through the mucin layer using a mucus-on-a-chip model
- Saurabh Dubey

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Micro/nanoplastics (MNPs), pervasive environmental pollutants, are increasingly recognized for their ability to infiltrate biological systems and pose serious health risks. A critical but understudied entry route is their interaction with and translocation through mucosal barriers—viscoelastic protective linings of the respiratory, gastrointestinal, and reproductive tracts. In this study, we present a physiologically relevant mucus-on-a-chip platform designed to investigate the mechanisms governing MNP transport across mucosal interfaces and their potential access to the vascular system. We first characterized the rheological properties of mucin at concentrations ranging from 20 mg/mL to physiological levels (~80 mg/mL) using microrheology. These measurements revealed that the mucus layer exhibits complex viscosity and elastic modulus values strongly influencing MNP penetration dynamics. The platform integrates a tunable mucin hydrogel layer to replicate native mucosal architecture and includes mucous-secreting epithelial cells to mimic biological response. To capture the physical transport mechanisms, we combined in vitro experimentation with computational fluid dynamics (CFD) simulations using the Carreau viscosity model, which accurately reflects the shear-thinning behavior of mucin. Fluorescently labeled MNPs (100 nm–5 µm) were introduced under controlled flow conditions, enabling real-time visualization and quantification of their interactions with the mucin layer. Key parameters measured included particle retention, penetration rate, and translocation across epithelial and vascular-mimicking compartments. Our results reveal a strong dependence on size and surface properties: nanoplastics smaller than 200 nm exhibit significant permeation through the mucin layer, particularly when surface charge and hydrophobicity are minimized, whereas micron-sized particles accumulate at the interface with limited penetration. Additionally, prolonged exposure to MNPs induces structural alterations in epithelial cells and triggers early inflammatory responses, indicating compromised barrier integrity. This integrated platform offers a scalable, biomimetic alternative to animal models for evaluating mucosal permeability and systemic exposure risk. The analysis reveals how MNPs circumvent biological barriers, leading to inflammation, immune disruption, and increased vascular risks.

45. Insights on short-term urinary variability and exposure sources of bisphenols and phthalates through Questionnaire- and Urine-based Exposure Source Tracking (QUEST)
- Danielle E. Que

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Human biomonitoring (HBM) is an ideal approach to assess internal exposure to exogenous chemicals as it accounts for all exposure pathways. This includes measurement of biomarkers with short-elimination half-lives and are excreted in urine allowing direct assessment of recent exposure (i.e., spot urine). Due to their fast excretion rates, the levels of urinary biomarkers can fluctuate considerably depending on an individual's changes in exposure to potential sources such as diet, use of personal care products and daily routines. Repeated sampling is usually required to accurately reflect long-term exposure. Understanding the variability of biomarkers in urine is essential in optimizing the design of HBM studies. The Questionnaire- and Urine-based Exposure Source Tracking (QUEST) project aims to investigate the variability of a wide range of biomarkers of exposure using urine samples collected with high frequency over the course of a week. In addition, it also aims to better understand sources of exposure by pairing each urine sample with a questionnaire which allows insight of potential exposure sources. This study recruited 5 male and 5 female adults to participate in a pilot campaign. The participants were administered two types of questionnaires: 1) "profile questionnaire" which collects general information on demographics, diet, personal care product use, physical activities, lifestyle and medical history and the 2) "sample questionnaire" which is filled out with every urine collected to capture recent and short-term changes in exposure patterns. The urine samples will be analysed for exposure to bisphenols and phthalates which are plastic associated chemicals known for their endocrine disrupting properties. For the short-term variability assessment, the urine concentrations will be analysed for within- and between-day and within- and between-person variabilities. Associations of the urinary concentrations with questionnaire answers will also be evaluated to determine potential exposures to bisphenols and phthalates. Ultimately, this project will extend its scope to other chemicals of emerging concern.

46. Detection of micro- and nanoplastics in paired cerebrospinal fluid and blood: Implications for neurological diseases

- Tingting Wang

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The exponential growth in global plastic production has resulted in pervasive environmental contamination of micro- and nanoplastics (MNPs). Although MNPs have been detected in various human specimens, their presence in the central nervous system and potential neurological impacts remain poorly understood. This study investigated MNP concentrations in paired cerebrospinal fluid (CSF) and blood samples from patients with neurological disorders, and assessed potential associations with cerebral metabolic changes. We analyzed paired CSF (n=20) and blood (n=20) samples from individuals with neuroimmune diseases, neuroinfectious diseases, and controls using pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) to quantify 11 types of MNPs. Blood-brain barrier (BBB) permeability was evaluated using the CSF albumin index (CSF-AI). Additionally, untargeted metabolomic profiling of CSF was performed to identify associated metabolic alterations. Five types of MNP polymers, namely PVC, PA66, PE, PP, and PS, were detected in both biofluids. Total MNP concentrations were significantly higher in blood (121.43-151.52 μg/mL across groups) than in CSF (7.59-16.07 μg/mL across groups). Strong correlations between CSF and blood MNP concentrations were observed in the neuroimmune ($r=0.56$, $p<0.001$), and neuroinfection ($r=0.52$, $p<0.01$) groups, but not in the controls ($r=0.01$, $p>0.05$). The neuroimmune and neuroinfection groups exhibited significantly higher CSF-AI compared to the control group ($p < 0.05$). Metabolomic analysis revealed 23 disrupted pathways in the high MNP group, including FcγR-mediated phagocytosis and glycerophospholipid metabolism. Specific metabolites like N2-Acetylornithine were strongly correlated with MNP levels ($r=0.75$, $p<0.01$). This pilot study demonstrated that different MNP polymers had varying abilities to cross the human BBB, especially when it was compromised. Furthermore, metabolomic analysis linked MNP exposure with metabolic changes in the brain, underscoring the need for further investigation into their roles in neurological diseases.

47. Microplastics in Commercial Fish and Surface Water from Sampaloc Lake, San Pablo City, Laguna, Philippines

- Ariel B. Lanceta Jr

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This study presents a comprehensive assessment of microplastic pollution in Lake Sampaloc, Philippines, focusing on both environmental presence and biological uptake in fish species of economic importance. Despite growing global concerns on freshwater microplastic contamination, data remain scarce for tropical inland waters. To address this gap, surface water samples were collected across distinct lake zones, revealing microplastic concentrations between 4367 and 5033 particles/m^3, with the highest contamination observed near residential areas (5033 particles/m^3). Detailed characterization showed fibers as the predominant microplastic type (mean: 95–97 particles/sample), followed by fragments and microbeads. Particle color analysis identified black (47.02%), blue (26.49%), and yellow (32.82%) as dominant, while size distribution peaked in the 1.01–2 μm range (mean: 20.67 ± 6.11 particles), indicating a significant presence of smaller particles likely resulting from environmental degradation. Microplastic ingestion was detected in 53% of fish samples from four species, with Chanos chanos exhibiting the highest contamination level (15 ± 2.0 particles in gill tissue). Farmed fish showed significantly greater microplastic loads (1.26 ± 0.32 particles/fish) compared to wild counterparts (0.52 ± 0.13 particles/fish), highlighting potential exposure differences linked to aquaculture practices. Morphotype analysis revealed fragments accounted for 75% of ingested particles, followed by fibers (19%) and films (5%), while blue-colored microplastics were most frequently ingested across all species. FTIR spectroscopy identified polyethylene (50–65%) and polypropylene as dominant polymer types consistently found in both environmental and biological samples. Pearson correlation analysis demonstrated a strong positive correlation ($r = 0.691$) between fish size and fiber ingestion, suggesting size-dependent bioaccumulation pathways, whereas fragment and film ingestion showed weak negative correlations with biometric parameters. Collectively, these findings provide critical baseline data on microplastic contamination in a tropical freshwater ecosystem, linking environmental concentrations to biological uptake and raising concerns about potential ecological and human health risks associated with microplastic pollution in economically important fish species.

48. A spatio-temporal systematic evidence map of exposure to bisphenols and their alternatives: Social and environmental justice

- Bhedita Jaya Seewoo

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Background: Bisphenol A (BPA) and a growing number of its structural analogues and functional alternatives are widely used in consumer plastic products and therefore have high exposure potential. Although biomonitoring studies have measured human exposure worldwide, there is no global synthesis of exposure levels. Objectives: To systematically map concentrations of bisphenols and alternatives measured in human bio-samples, visualising exposure patterns by country, population characteristics, and over time, and to identify research gaps. Methods: Primary studies that measured concentrations of at least one of 90 relevant bisphenol chemicals and/or alternatives in human bio-samples were included. MEDLINE®, Embase and Web of Science (WoS) databases and 15 grey literature sources were searched. Backward and forward citation tracking of included studies supplemented the database searches. We extracted data on study design, geographic location, biospecimens analysed, participant demographics, and measured bisphenol concentrations. We coded populations at high risk of exposure including plastic industry workers, fenceline communities, and residents of Small Island Developing States (SIDS) and high plastic waste countries, children in their first 1000 days of life and the elderly. Results: This SEM includes 825 primary research articles covering participants across 64 countries from 2010–2023. Studies were disproportionately concentrated in high-income countries, with limited evidence from low-income countries and SIDS. BPA was the most frequently measured chemical, while data on BPA analogues and non-bisphenol alternatives were sparse. Pregnant women and children under 1000 days of age were commonly studied, but sociodemographic variables, including socioeconomic status and race/ethnicity, were inconsistently reported. Few studies examined exposures in elderly populations or in workers or residents near plastics production and waste facilities, and none explicitly considered sexual and gender minority populations. Conclusions: This first systematic evidence map of bisphenol and alternatives exposure highlights major gaps in geographic coverage, sociodemographic reporting, and chemical scope. Geographically diverse studies and explicit equity considerations are essential to strengthen the evidence base and guide just interventions.

49. Occurrence and Assessment of Human Exposure to Microplastic Particles in Bottled Water from Southwest, Nigeria

- Oluwatosin Sarah Shokunbi

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The investigation of microplastics (MPs) in different environmental media is well documented; however, the prevalence and possible human health risks of MPs in bottled water are not fully understood. This study was designed to (a) determine the quantity, form, colour, and size of MPs, (b) evaluate the influence of physicochemical properties on the release of MPs in bottled water, and (c) estimate the daily intake (EDI) of MPs in eight distinct varieties of bottled water from Southwest, Nigeria. The Rose Bengal staining method and microscopic analysis were employed to identify, quantify, and characterize the MPs. The bottled water brands from Southwest Nigeria contained MPs of various shapes, colours, and sizes. The average abundance of MPs was 15.2 ± 2.9 particles/L, with the highest abundance being 21.3 ± 1.8 particles/L/L. Fibres (82%) were the most detected shape of MPs, followed by fragments (18%), with transparent and blue being the two colours observed. Particle sizes ranged from 0.2 to 2.5 mm. The concentrations of MPs in the bottled water were strongly correlated ($r = 0.789$, $P < 0.01$) with the pH of the water samples. Adults had an estimated EDI of 0.31 to 0.66 particles/kg bw/day, while children's EDI ranged from 1.13 to 2.36 particles/kg bw/day. These findings provide insights for scientists to better understand the contamination of bottled water by MPs and help regulatory bodies formulate appropriate regulations for the production and bottling of drinking water. Keywords: microplastics, drinking water, daily intake human exposure, health risk, regulations.

50. Plastisphere Dynamics in the River Ganges: Interlinking Microplastics, Co-Contaminants, and Microbial Communities to Human Exposure Risks

- Deepika Sharma

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Microplastics (MPs), defined as the plastic particles smaller than 5 mm, have emerged as complex environmental pollutants that interact with the physical, chemical and biological (microbial) components to form the plastisphere—a dynamic interface with potential ecological and human health implications. The River Ganges, the lifeline of the population residing in the Indo-Gangetic plains, faces mounting pollution from unmanaged waste, industrial effluents, and urban runoff. This study presents an integrated assessment of MPs, co-contaminants, and microbial diversity along the river to evaluate multi-pathway exposure risks. Water, sediment and macro-plastic (greater than 5 mm) samples were collected from multiple stations spanning the upper, middle, and lower reaches of the Ganges. MPs were isolated using standardized laboratory methods from water and sediment. Further, characterized for morphology and polymer type via microscopy and spectroscopic techniques. Various polymers such as polystyrene, polypropylene, polyethylene, and polytetrafluoroethylene were detected along the stretch of the river from upper pristine ecosystem till the lower heavily populated banks. The shapes included mostly fibers and films along with fragments. Physicochemical analysis and metal quantification revealed elevated levels of heavy metals (Pb, Zn, Cu, Cr and Fe) in urban stretches, indicating potential sorption and transport interactions with MPs. The presence of heavy metal was also detected by studying the surface morphology as well. Heavy metals are known for their persistence and toxicity. Their affinity for microplastic surfaces through adsorption and complexation suggests a synergistic pathway for contaminant transport, bioaccumulation, and potential human exposure through water, food, and sediments. Metagenomic sequencing of the corresponding water samples revealed significant spatial variations in microbial diversity correlated with MP and metal concentrations. Functional annotation identified genes associated with antibiotic resistance, plastic and xenobiotic degradation, and stress adaptation, suggesting the selection of functionally active microbial communities in polluted zones. This study demonstrates the interconnected nature of the freshwater plastisphere and highlights the need for integrated monitoring frameworks and policy interventions to protect ecosystems and human health by addressing co-contaminant interactions.

51. Retrospective analysis of German populations highlights elevated 6:2 fluorotelomer sulfonate in both serum and cerebrospinal fluid from patients diagnosed with schizophrenia

- Tim Couttas

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Per- and polyfluoroalkyl substances (PFAS) are persistent environmental pollutants with documented ability to bioaccumulate in human tissues and cross protective biological barriers, including the blood–cerebrospinal fluid (CSF) barrier, critical in maintaining central nervous system (CNS) homeostasis. Understanding potential differences in PFAS accumulation for individuals with neurological and neuropsychiatric disorders is an area of significant interest. This study employed LC-MS/MS to retrospectively analyse PFAS in pre-extracted biofluids, originally collected and subsequently archived at psychiatric institutes belonging to the University of Cologne (paired serum-CSF, n=78), and the Central Institute of Mental Health, Mannheim (serum only, n=53) between 2000 and 2017. Among the 13 PFAS detected, 6:2 fluorotelomer sulfonate (6:2 FTS), an analogue and replacement of perfluorooctane sulfonic acid (PFOS) in various industrial uses, demonstrated significant condition-related increases across both geographic populations. In the Cologne cohort, 6:2 FTS was significantly elevated in both the serum and CSF of patients diagnosed with schizophrenia (SCZ) who were antipsychotic-naïve (SCZnaïve: serum, p=0.024; CSF, p=4.4×10-4, n=28) or undergoing treatment with D2/5-HT antagonists (SCZtreat: serum, p=0.0036; CSF, p=1.3×10-5, n=27) compared to healthy volunteers (HVs, n=23). These findings were independently replicated in serum samples obtained from the Mannheim cohort, where participants diagnosed with schizophrenia, irrespective of treatment status (SCZmix, n=21), exhibited significantly elevated serum 6:2 FTS (p=0.0435) compared to HVs (n=32). Critically, in the Cologne cohort, CSF/serum albumin quotients revealed significantly compromised blood-CSF barrier integrity in both SCZnaïve (p=0.012) and SCZtreat patients (p=0.001) relative to HVs, with 6:2 FTS demonstrating higher CSF/serum ratios compared to legacy PFAS that could not be rationalised by barrier dysfunction alone. To our knowledge, this is the first examination of PFAS in paired serum–CSF samples from a European population, spanning two independent schizophrenia cohorts, revealing consistently elevated 6:2 FTS, underscoring the need to clarify its neurobiological and environmental health implications.

52. Exposure to microplastics through fish consumption: tests on different species caught in different environments (marine, brackish and lake)

- Laura Cutroneo

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Plastic and microplastic pollution have become a pervasive threat to aquatic ecosystems worldwide. This study investigated the presence of microplastics in the stomach contents of many fish species sampled from four aquatic environments, chosen based on the various degrees of impact of human presence and activities. Sampling sites were marine (a), brackish (b), and lacustrine (c): (a) the Port of Genoa (Northwestern Italy), a commercial port overlooked by the densely populated area of the city of Genoa, and the Puyuhuapi Fjord (Northen Patagonia, Chile), a fjord surrounded by hills full of rich vegetation; (b) the S'Ena Arrubia fishpond, a protected natural inshore pond (Western Sardinia, Italy); (c) and the Lake Lavezze (Ligurian Apennines, NW Italy), an artificial reservoir that supplies the aqueducts of the City of Genoa. The presence of plastics was verified in the following fish depending on the area of capture. Mullets (Liza aurata, Liza ramada and Mugil cephalus) were collected in the Port of Genoa and in the S'Ena Arrubia fishpond; mullets are fish commonly caught and consumed in Italian and Mediterranean seas. In the Puyuhuapi Fjord of Chile, we worked on specimens of pink cusk-eel (Genypterus blacodes) and cod (Merluccius australis), species important to the Chilean fishing industry. Sun perches (Lepomis gibbosus) were considered in the Lake Lavezze. Microplastics or artificial items (e.g. fibers with artificial dyes) were found in fish from all areas considered. This study confirms the ubiquity of microplastics in the aquatic environment and the possible exposure of human health to them (and to the possible micro-pollutants associated with them) through fish consumption. The use of stomach content to assess plastic contamination in fish is confirmed to be a valid tool.

53. Microplastics as Adsorbents of Heavy Metals in Soil: Insights for Exposure Assessment

- Sheha Shaji

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The interaction between microplastics and co-contaminants in soil ecosystems is an expanding field of interest, especially regarding the capacity of microplastics to function as mobile adsorbents. This work aims to investigate the adsorption characteristics of heavy metals on two prevalent microplastic types—polyethylene terephthalate (PET) and polypropylene (PP)—in both pristine and aged states inside soil porous media. Batch adsorption studies will be performed to assess the impact of microplastic ageing on heavy metal retention, supplemented by surface characterisation techniques. The results are anticipated to elucidate the influence of microplastics on the transit and retention of heavy metals in subsurface environment, providing mechanistic insights that are relevant for understanding potential contaminant mobility and exposure pathways, and also contribute towards shaping risk assessment and management strategies for soil and groundwater systems. Keywords: Microplastics; Heavy metals; Adsorption; PET; Soil.

54. Biocompatible Ionic Liquids for Sustainable PET Recycling: Reducing Human Exposure to Hazardous Chemicals Through Green Chemistry Approaches

- Zahra Mohammadizadeh Tahroudi

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Chemical recycling of polyethylene terephthalate (PET) typically employs hazardous solvents that pose significant occupational health risks and generate toxic byproducts. This study presents a health-centered approach using biocompatible choline-based ionic liquids (ILs) as safer alternatives, directly addressing worker and environmental exposure to harmful chemicals during plastic recycling. We evaluated three choline-based ILs (glycinate, phosphate, acetate) selected for their low toxicity and biodegradability, comparing conventional (160°C, 12h) versus microwave heating (210W, 20min). Unlike toxic imidazolium-based ILs or harsh acids/bases presenting inhalation and dermal exposure risks, our biocompatible system achieved 80-90% PET conversion without hazardous additives. Critically, all ILs demonstrated exceptional water tolerance (up to 30 wt.%), eliminating energy-intensive dehydration that generates harmful volatile organic compounds (VOCs). Microwave processing reduced exposure duration from 12 hours to 20 minutes, minimizing worker contact with elevated temperatures and potential aerosol formation. Product analysis revealed heating-dependent pathways: conventional heating yielded primarily terephthalic acid (TPA), while microwave heating produced both TPA and bis(2-hydroxyethyl) terephthalate (BHET). Human health implications: Our approach (1) eliminates exposure to carcinogenic solvents, (2) reduces microplastic formation during processing, (3) minimizes VOC emissions through water tolerance, and (4) shortens exposure duration via rapid processing. These biocompatible ILs offer a pathway toward safer occupational environments in recycling facilities while maintaining industrial scalability, addressing critical health concerns across the plastic lifecycle, and supporting the development of health-conscious circular economy infrastructure.

55. Microplastics in Bottled Drinking Water from India: Characterization and Human Exposure Risk - Vishal Singh Pawak

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The pervasive presence of microplastics (MPs) in drinking water has raised global concerns for human health and environmental safety. This study presents a detailed investigation of MP contamination in bottled drinking water from six major Indian brands, employing Nile Red fluorescence microscopy, field emission scanning electron microscopy with energy-dispersive X-ray spectroscopy (FESEM-EDX), and micro-Raman spectroscopy for comprehensive characterization. MPs were detected in 100% of the samples, with concentrations ranging from 808 to 1,888 particles/L (average 1,279 ± 129 particles/L), exceeding levels reported in most international studies. Morphological analysis revealed that fragments (56.7%) were the dominant type, and over 91% of MPs were smaller than 40 µm. Polymeric identification showed PET, PS, PE, and PP as the most prevalent polymers, correlating with commonly used packaging materials. Color analysis indicated that transparent/white MPs (54.8%) were most frequent, followed by black and colored particles, suggesting that the bottle body, caps, and handling-induced degradation are the primary sources. Estimated annual human intake values indicate potential exposure, particularly among children. These findings highlight the urgent need for regulatory frameworks to establish MP thresholds in drinking water, improve packaging standards, implement standardized analytical methods, and explore alternate packaging solutions. Overall, this study provides critical insights into microplastic prevalence in commercially packaged water in India and underscores the necessity for public health interventions and sustainable packaging strategies.

56. Safe and sustainable by design approaches to reduce microplastic emissions from aquaculture nets - Andy Booth

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Microplastic (MP) emissions from aquaculture nets, especially during in-situ cleaning operations, are a growing environmental and human health concern. The emitted particles can contaminate both the environment and food species being reared for human consumption. The SMARTER project evaluated these emissions by combining laboratory abrasion tests and field assessments, evaluating safe-and-sustainable-by-design (SSbD) options. Laboratory abrasion testing simulating abrasion damage from net cleaning operations revealed clear material/age-dependent MP emission patterns. Conventional nylon nets released up to five times more MPs than monofilament high-density polyethylene (HDPE) or ultra-high-molecular-weight polyethylene (UHMWPE), underscoring the vulnerability of multifilament structures to mechanical wear. Coating–substrate compatibility further influenced emissions, with premium antifouling coatings significantly increasing MP release from nylon, likely due to thicker, less integrated layers. UHMWPE nets showed no such increase, suggesting superior coating adhesion and abrasion resistance. Additionally, used nets released more MPs than new nets, especially in high-abrasion zones just below the waterline and at the bottom. Accelerated net cleaning experiments found MP concentrations in surrounding seawater to be near background levels for pressure washing, cavitation and autonomous underwater vehicle (AUV) brushing. However, microscopy showed that AUV brushing caused a thinning of the coating (least damage), with pressure washing and cavitation cleaning leading to fragmentation of the coating and a higher degree of damage. Field campaigns conducted during routine net cleaning captured sporadic, highly variable MP signals influenced by net age, cleaning history and site conditions. At on-shore net-cleaning service stations, detectable MPs were generated, but high-capacity filtration successfully retained particles, preventing discharge in the marine environment. These studies demonstrate that MP emissions from aquaculture nest depend by polymeric composition, coating compatibility, product ageing and maintenance practice. By adopting design-informed choices for materials and cleaning technologies, aquaculture systems can significantly reduce MP emissions at the source, aligning with SSbD principles to minimise environmental and human health impacts while maintaining operational performance.

57. Sex differences in dietary plastic exposures, body adiposity and associations with urinary bisphenol and phthalate levels: The PERTH cohort study.

- Amelia Harray

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Plastic-associated chemicals, such as bisphenols and phthalates, are endocrine disruptors and linked to cardiometabolic, reproductive and neurological conditions. Exposure occurs via ingestion, inhalation and dermal absorption. Little is known about biological sex differences in dietary plastic exposures and if body adiposity influences urinary levels. We aimed to examine this data from the Plastic Exposure Reduction Transforms Health (PERTH) cohort, a major Australian study investigating sources and determinants of plastic exposure. Participants (18-60years) completed clinical and demographic assessments, body composition analysis, and repeated dietitian-administered 24-hour Dietary Recall–Plastic Exposure interviews (informing the Dietary Plastics Score). Contemporaneous 3-daily urine samples were pooled for bisphenol and phthalate measurement and creatinine adjusted. Statistical analysis used R and reported within-person effects for dietary associations, and between-person effects for body composition. 211 adults (58% female;43.1±12.5 years) completed the study and all had ≥6 urinary metabolites on any given day. Mean daily Dietary Plastics Score was 41.6±13.6 plastic touchpoints. Females consumed more foods in plastic(P=0.006) and individually packaged foods(P=0.039), compared with males. Participants with a body mass index ≥25kg/m2 consumed more individually packaged foods(P=0.016). In females, increased ultra-processed foods were associated with increased mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP)(P=0.014) and mono(5-carboxy-2-ethylpentyl) phthalate(P=0.037). Increased plastic food packaging was associated with increased MEOHP in males(P=0.035). Higher fat mass index (kg/m2) was associated with lower urinary mono-benzyl phthalate(P=0.011), mono(2-ethylhexyl) phthalate (MEHP)(P<0.001), MEOHP(P=0.004) and sum of di(2-ethylhexyl) phthalate (DEHP)(P=0.029) in females, and lower MEHP(P=0.003) in males. Higher visceral adipose tissue and waist circumference were associated with lower MEHP in both sexes. Waist to hip ratio was positively associated with bisphenol A in males only(P=0.012). Although urinary bisphenol and phthalate metabolite levels are determined by plastic exposure, individuals with higher adiposity excreted lower levels of urinary DEHP metabolites. This was enhanced in females and most apparent for MEHP. Investigation of interactions of adiposity with distribution, metabolism and elimination of DEHP should be an aim of future studies.

58. How Synthetic Clothing is Driving the Use of Non-Essential Chemicals

- Hannah Mullen

Hannah Mullen[1], Nick Florin[1], Rachael Wakefield-Rann[1], Taylor Brydges[2]

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The fashion industry is known for excessive rates of production and consumption, with Australia one of the largest consumers of clothing globally. Nearly 70% of global fibre production is synthetic fibres, which are estimated to be responsible for 16%-35% of microplastic pollution in oceans. The dominance of synthetic fibres is a key driver behind the rise of chemical finishes on clothing to substitute properties once provided by natural fibres such as cotton and wool. Antibacterial finishes are one example, which are used in clothing such as outdoors-wear, activewear, socks and underwear, to prevent synthetic fibres from smelling. Nanosilver is a type of antibacterial finish which has been found to be toxic to human health and ecosystems and can lead to antibiotic resistance. Given these concerns, a precautionary approach would be to minimise their use in non-essential products such as clothing. However, they are largely unregulated and remain in use today. This poster presents an analysis of antibacterial claims on 162 Australian clothing brands websites, to better understand the likely use of nanosilver. The desktop analysis is supported by interviews with brands to identify the key drivers for using antibacterial finishes on synthetic clothing. It was found that 42% of brands reviewed were likely to be using a chemical finish for non-essential anti-odour purposes. The brand interviews found the main drivers for using synthetic fibres and antibacterial finishes, rather than natural fibres, were cost, marketing, consumer expectations and durability. The likely widespread usage of nanosilver found in this study highlights how the switch to synthetic clothing may be contributing to an increase in toxic chemicals, leading to further harm to human health and ecosystems. To address this problem, an understanding of the reasons behind the use of synthetic clothing and chemical finishes, as presented in this study, is needed as a first step to change the behaviour of the decision makers driving the production of these clothing items, the brands. Additionally, the findings justify the need for further analytical research to quantify the extent of use of nanosilver in clothing. This presentation is in the interests of governments, policymakers, recyclers, manufacturers, designers and researchers who are grappling with reducing the use of synthetic fibres and hazardous chemicals, particularly in the transition to a safe circular economy for clothing in Australia.

59. Preliminary Exposure Results of Bisphenols through Adriatic Sea Bivalves
- Tanja Bogdanović

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Bisphenols (BPs) are environmental contaminants of concern, particularly in aquatic ecosystems. Bivalve molluscs are effective bioindicators due to their benthic nature, ability to filter water, and capacity to bioaccumulate persistent pollutants. Diet is a major route of human exposure to bisphenols, and seafood is a significant dietary component. This study analyses bisphenols in four bivalve species (Mytilus galloprovincialis, Chlamys varia, Callista chione, and Venus verrucosa) along the Croatian coast of the Adriatic Sea during the spring and autumn of 2024. Five bisphenols were analyzed in bivalves: bisphenol A (BPA), bisphenol AF (BPAF), bisphenol B (BPB), bisphenol F (BPF), and bisphenol S (BPS). All BPs except BPF were found in the bivalves, indicating pervasive contamination. The total BPs concentration in bivalves ranged from 0.065 to 21.33 µg/kg. Mytilus galloprovincialis exhibited the highest levels of these compounds. Notable variations were observed in both the quantity and BPs profile across different species and seasons, with BPA and BPS emerging as the predominant constituents. BPA exposure poses significant risk to the public health, with a calculated Hazard Quotient (HQ) of 76.7 which exceeds the risk control threshold of 1. This underscores the urgent need to implement strategies needed to protect consumers from excessive BPA intake through bivalve consumption.

60. Impact of Microplastics on the Severity of Intestinal Inflammation in Mice
- Claire Masi

Claire Masi[1], Melissa Curaku[1], Fanny Kopp[1], Nina Touly[1], Chloé Robert[2], Benoit Chassaing[2], Natacha Dreumont[1], Marie Boudaud[1], Djésia Arnone[1]

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Inflammatory Bowel Diseases (IBD), including Crohn's Disease and Ulcerative Colitis are multifactorial disorders influenced by environmental factors like diet, stress, pollutant exposure or medication use. Microplastics (MPs) are ubiquitous environmental contaminants derived from plastic degradation. Their widespread presence leads to contamination of the food chain, yet their health impact remains poorly defined. They have recently emerged as potential contributors to intestinal dysfunction through their potential impact on the intestinal barrier and microbiota. Studies in wildlife and livestock have revealed the presence of MPs found in the feces, and a study reported differences in MPs type and concentration between healthy individuals and IBD patients, with correlations to disease severity. These findings support further research on the potential harmful effects of MPs on gut homeostasis. 8-weeks old Male C57BL/6 mice were exposed for 4 weeks to 3 MPs types (Polyamide, Polyvinyl Chloride, Polyethylene Terephthalate) in 2 particle sizes (0.5 and 5 µm), either individually or as a mixture, via drinking water. Controls received filtered water. Chronic colitis was induced with 2% DSS (Dextran Sodium Sulfate) in drinking water for 4 cycles of 5 days. Mice were monitored daily to establish a Disease Activity Index. Colonoscopy was performed at the end, and organs were collected. Clinical, endoscopic, and histopathological scores were then assessed. Microbiota composition was analyzed through 16S rRNA sequencing. Mixture of the 3 polymers worsened the clinical score during the 1st DSS cycle, but this was not reflected in an increase of the final endoscopic score. Also, MPs consumption, combined or not with DSS, was sufficient to significantly alter the intestinal microbiota composition, with differential effects depending on the polymer consumed by the mice. Fecal lipocalin measurements after each DSS cycle and ongoing histopathological analyses should provide further insight into the observed increase in severity among mice exposed to the MPs cocktail. These data suggest a "cocktail effect" of MPs during early colitis and confirm that MPs exposure alters the intestinal microbiota composition. They will be complemented by histopathological and immunohistochemical analyses. These initial results strengthen existing knowledge about the harmful effects of MPs pollution on human health and support the need to unravel the underlying mechanisms.

61. Plastic in our water: what Australians may be drinking
- Elvis Okoffo

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Microplastics (MPs; >1 μm) and nanoplastics (NPs; <1 μm) are increasingly recognised as pervasive contaminants in human environments, yet robust assessments of their presence in municipal drinking water remain scarce. This study will deliver the first comprehensive, Australia-wide investigation of plastic particles in treated drinking water across all six states - New South Wales, Victoria, Queensland, Western Australia, South Australia, and Tasmania and the two self-governing territories, the Australian Capital Territory (ACT) and the Northern Territory (NT). Using an integrated analytical framework that combines pyrolysis–gas chromatography–mass spectrometry (Pyr-GC-MS) with advanced particle-tracking and imaging techniques, we will quantify and characterise MPs and NPs in a diverse range of municipal water supplies. This multi-technique approach enables simultaneous determination of particle mass, polymer identity, size distribution, and morphology, providing a robust foundation for assessing potential population-level exposure from drinking water. The study is expected to produce Australia's first nationally representative dataset on micro- and nanoplastics in municipal drinking water and to identify key factors influencing their occurrence. These anticipated outcomes will support future risk assessments, inform harmonised monitoring and reporting frameworks, and guide evidence-based policy aimed at safeguarding drinking water quality. By establishing essential baseline data, this work will strengthen Australia's leadership in micro- and nanoplastic research and provide critical insights into human exposure to emerging environmental contaminants.

62. Built with plastic: revealing the ubiquitous use of plastics in light timber-frame housing in Australia and New Zealand, and potential impacts on human and environmental health
- Polly Stupples

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Although rarely discussed as such, buildings are the second-largest consumer of plastics globally, and therefore inevitably contribute to associated human health and environmental harms. Plastics have become a common part of layering systems in walls, floors, roofs, where they help with waterproofing, insulating, separating, and much more. Plastic waterpipes dominate the market, and electrical cables are encased in plastics. The majority of adhesives and coatings are also chemically plastic-based, and those are especially likely to be released into the environment as they wear out. Additionally, a number of single-use or short-use plastic items are consumed during building construction.

However, despite their ubiquity, the significant and growing use of plastics in construction remains relatively invisible. Plastics may be present as films, paints, coatings or adhesives; they may be hidden inside thermally efficient 'eco-certified' products, or they might be part of composite (co-moulded) materials – impossible, at end of use, to reuse or recycle. Their toxicity may or may not be publically known (Petrović, 2024). Their release into the environment can be hard to see even when toxicity is acknowledged, as it can be incremental (shedding, peeling, dessicating), buried in landfills or burned, creating legacy pollution for future generations.

In this poster, we map typical uses of plastics in contemporary construction of light timber-frame buildings in New Zealand and Australia. We analyse identified applications of plastics for their potential to off-gas and shed microplastics indoors; the likelihood of harmful decomposition in the natural environment following an accidental release; and the toxicity impacts of disposal of these materials. We aim to raise awareness of the construction industry's contributions to the problems of microplastics, toxicity effects and other synthetic pollution, as a first step towards transitioning away from plastics in construction.

Petrović, E. K., Gjerde, M., Chicca, F., & Marriage, G. (Eds.). (2024). Sustainability and toxicity of building materials : Manufacture, use and disposal stages. Elsevier Science & Technology.

63. Serum PFAS concentrations in the Australian population: Comparison between data from the National Health Measure Survey (NHMS) and pooled deidentified serum from a pathology laboratory - Julia Orr

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Since 2002, the Queensland Alliance for Environmental Health Sciences (QAEHS) have conducted a globally unique human biomonitoring (HBM) program based on the subsampling and pooling of deidentified surplus pathology specimens - a low-cost and efficient alternative to traditional methods. This program has been vital to discerning baseline serum concentrations and trends of environmental pollutants in the Australian population. However, limitations with this approach concern the fitness for purpose of pathology samples for assessing population exposure to chemicals (i.e. due to a sampling bias towards "sick" individuals; contamination from routine pathology testing) and the constraints of reporting arithmetic mean concentrations for each pool as opposed to a range of individual results. In 2025, the Australian Bureau of Statistics (ABS) released age and sex-stratified data on serum PFAS concentrations for the National Health Measures Survey (NHMS), which was based on approximately 6900 individual specimens from a representative sample of the population. This is the first time that two independent HBM programs (NHMS and QAEHS HBM Program) were conducted at the same time, providing the opportunity to compare PFAS exposure estimates derived from each program. This study aims to provide a first comparison of the PFAS data from the NHMS and the QAEHS HBM to assess if there are systematic differences in a) mean PFAS concentrations for different PFAS congeners and b) mean PFAS concentrations for different strata (i.e. age, sex) between these two studies. Preliminarily, we focused on mean serum PFAS concentrations for males and females within the ≥30-<45 years age group; the only comparative age group stratum between the publicly available NHMS data (2022-24 collection period) and QAEHS HBM data (2022-23 collection period). Mean levels of PFOS, PFOA and PFHxS for males were 2.88, 1.16, and 1.54 ng/µL, and 2.42, 1.02, and 1.49 ng/µL for the QAEHS HBM and NHMS datasets respectively. For females, mean levels were reported as 1.86, 0.87, 0.71 ng/µL for QAEHS HBM samples, and 1.16, 0.68 and 0.49 ng/µL for the NHMS data. Mean serum PFAS concentrations derived from the NHMS data were slightly but consistently lower than those from the QAEHS HBM program. The magnitude of the reported differences was specific to individual PFAS congeners. The laboratories that undertook the analysis for each study included identical NIST standard reference material, with the resulting QA/QC data suggesting that the observed differences were not attributable to analytical variations. Importantly, the observed age and sex-specific PFAS trends were broadly consistent between the two studies. An application to obtain the complete NHMS dataset of individual PFAS measurements has begun and will allow for comparison of data for all age groups and the evaluation of the basis for the observed differences within this investigation.

64. Dynamics of Microbiome and Resistome in Biodegradable Microplastic Biofilms in Response to Polycyclic Aromatic Hydrocarbon Stress: Mechanisms and Health Implications - Guiying Li

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Microplastics (MPs) in aquatic ecosystems constitute a distinct niche for the enrichment of microbiomes and antibiotic resistomes. Yet, the influence of environmental pollution stressors such as polycyclic aromatic hydrocarbons (PAHs) on dissemination of antibiotic resistance genes (ARGs) and virulence factor genes (VFGs) within plastisphere remains poorly understood. In this study, phenanthrene (Phe) was firstly employed as a representative PAH to investigate its effects on the propagation of ARGs and VFGs in biodegradable microplastics (BMPs) biofilms by metagenomic sequencing. Results demonstrated that Phe stimulated biofilm development on BMPs and profoundly reshaped the microbial community structure. Environmental-level concentration Phe reduced the abundance of ARGs and VFGs by inhibiting vertical gene transfer (VGT), as indicated by the decrease in chromosomal ARGs. However, it concurrently enhanced the abundance of plasmid-borne ARGs, implying an elevated propensity for horizontal gene transfer (HGT). Notably, the health risk of ARGs (HRA) under Phe stress increased by 1.26 to 1.30 times relative to the control, underscoring the role of Phe in potentiating the dissemination of ARGs via the plastisphere. Furthermore, co-occurrence of ARGs, VFGs, and mobile genetic elements (MGEs) was identified within multiple metagenome-assembled genomes (MAGs) of pathogens, pointing to a co-transmission risk between antibiotic resistance and virulence. This study provides novel insights into the combined impact of PAHs and microplastics in co-driving the dissemination of ARGs and VFGs in aquatic environments.

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65. A Multi-site Longditudinal investigation of chemical tracers of plastic waste burning in Indonesia - Shane Fitzgerald

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Indonesia's plastic waste is estimated at 4.8 million tonnes annually, roughly 50% of which is openly burned resulting in poor air quality in areas of East Java, posing a serious risk to public health. Burning of plastic waste releases chemicals that contribute to respiratory and cardiovascular diseases, cancers, and endocrine disruption. In this work, emission samples were collected each day for 48 days from two burning sites on quartz filters: Pagak, a limestone drying facility; and Areng, a tofu factory. Prior to analysis of the emission samples, plastic waste collected from Indonesia was burned in a sealed glass container in the lab and the chemicals released were collected on quartz filters via a hose. Samples were extracted in ethyl acetate and analysed using gas chromatography to characterise the chemical composition of the collected emissions. In the lab experiment, emissions were dominated by aliphatic and polyaromatic hydrocarbons. Dominant polyaromatic hydrocarbons were quantified at 0.3 – 2.9 ng per gram of plastic burned. Semi-volatile organic compound diversity across the field emissions samples was relatively limited on the profile-level. At the compound-level: plasticisers, dicyclohexylamine and bis (2-ethylhexyl) phthalate; burning tracers, m-phenyl terphenyl and benzo[a]pyrene; and levoglucosan, a biomass burning tracer, were consistently detected across both sites over the 48 day sampling periods. Significantly higher concentrations of benzo[a]pyrene and bis (2-ethylhexyl) phthalate were measured at the Areng tofu factory site. This poster provides an overview of the initial results obtained from this project.

66. A One Health approach to understand plastic pollution risks
- Aaron Schultz

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Microplastics (MP) have now been detected in remote geographical areas (Mariana trench, the Arctic, Antarctica and top of Mount Everest), in freshwater and marine environments, and the air we breathe. Previous research has also detected MP and nanoplastics (NPs) in beer, bottled water, salt and sugar, mussels, crustaceans, and fish increasing the risk of exposure to humans via the consumption of contaminated food and marine animals. The prevalence of MPs and NPs in the environment is regarded as a significant global threat due to their capacity to affect different organisms including humans. With this growing risk, the Environmental and Human Toxicology lab at Deakin is conducting transdisciplinary research using a 'One Health' approach (healthy people, healthy animals, and healthy environments) to identify the toxicity risks of MP and NPs to people, animals, and ecosystems. This includes monitoring MP concentrations in freshwater and marine environments, quantifying MP levels in native aquatic animals (freshwater shrimp, marine bivalves and limpets, sand hoppers), and assessing MP and NP uptake and toxicity responses in zebrafish embryos and human cell lines. Field work has detected MPs in surface water from an ecologically important Victorian freshwater lake, in freshwater shrimp and in water, beach sand samples along the surf coast of Victoria. In vivo experiments have revealed that zebrafish embryos exposed to polystyrene MP and NPs develop cardiovascular toxicity, including a reduced heart rate, pericardial oedema and impaired blood vessel development, and activation of the immune system (neutrophil proliferation). In human embryonic kidney cells (HEK-293), polystyrene MP and NPs have no effect on cell survival but cause a reduction in mitochondrial activity. Further research is required assessing the potential risks of MP and NPs to human health, including mechanisms of toxicity.

67. Detection and Quantification of Phthalates and Bisphenol A (BPA) in Oral Squamous Cell Carcinoma Using High-Resolution Time-of-Flight Mass Spectrometry
- Yokataa Geetha Saravanan

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Session topic: Toxicology Plastics-derived endocrine-disrupting chemicals such as phthalates and bisphenol A (BPA) are pervasive in contemporary life and have been implicated in hormone sensitive cancers. Their potential involvement in Oral Squamous Cell Carcinoma (OSCC), one of the most aggressive malignancies of the oral cavity, remains poorly defined. This study investigates the presence of these plastic-associated chemicals directly within oral cancer tissues to explore their potential toxicological impact on carcinogenesis, tumour progression, and malignant transformation. Formalin-fixed OSCC specimens were analysed using high-resolution Time-of-Flight Mass Spectrometry with Electrospray Ionisation (TOF-MS, ES+) across an extended m/z range. Distinct ion peaks corresponding to Bisphenol A [M + Na]+ (m/z 242.28) and phthalate derivatives, including DEHP-related fragments (m/z 293.09 and 502.35), were reproducibly detected and verified across replicates, confirming both exposure and potential tissue accumulation. Mechanistically, these compounds are known to interfere with estrogen-receptor signalling, disrupt redox balance, and induce epigenetic modulation in pathways that are intimately linked to oral carcinogenesis. Thus, their detection within OSCC tissues supports the hypothesis that chronic exposure to plastic-associated endocrine disruptors may act as an environmental co-factor in oral tumour initiation and progression. From a regulatory perspective, BPA and several phthalates are designated as substances of very high concern under the EU REACH framework and categorized under California Proposition 65 for carcinogenic and reproductive toxicity. Hence, the findings of this study emphasize the importance of integrating chemical analytics with mechanistic toxicology and human biomonitoring to better assess plastic-related cancer risks. This study provides one of the first chemical confirmations of plastic-derived contaminants in human oral-cancer tissues, offering new insights into their toxicological significance and reinforcing the need for preventive regulatory measures.

Keywords: Phthalates, Bisphenol A, Oral Squamous Cell Carcinoma, Endocrine Disruptors, Toxicology, Time-of-Flight Mass Spectrometry.

68. Assessment of a 7 day low plastic dietary intervention on parameters of good health

- Andrew Lucas

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Introduction: The Plastic Exposure Reduction Transforms Health (PERTH) study, investigated plastic exposure, and assessed strategies to reduce it. The reference cohort study recruited 211 clinically healthy individuals (aged from 18 – 60 years, 59% biological female) and assessed their exposure to 20 separate plastic associated chemicals (PAC), in urine samples. All participants showed exposure to at least 6 PAC, above limit of detection. A subset of these participants were then enrolled into a randomised clinical trial to assess various intervention strategies to reduce plastics exposure, with the primary outcome being changes in urine chemical concentrations from pre-intervention to the completion of the 7 day intervention period. Additionally, blood samples were taken at these time points. Methodology: Fasting blood samples were obtained before the start and following the finish of the 7 day intervention period, from participants of intervention groups (4 groups of n = 12/group) who received various low-plastic lifestyle interventions and from control participants (n=12), who made no lifestyle changes. PBMC and serum were prepared and a suite of clinical blood tests, multiplex serum cytokine measurement and adipokine ELISA were conducted. Results and Discussion: Pre and post intervention measurements within individual participants, showed no significant differences for the adipokines adiponectin and leptin and for clinical measures of lipids, liver function, kidney function or of systemic inflammation. Additionally, serum multiplex cytokine measurements of participants from the maximal intervention group, who were supplied with low plastic food, personal care products and plastic free cookware, and the control group participants, also showed no significant differences over the course of the intervention, and neither was there any clear difference in the range and magnitude of cytokines measured in either the intervention or the control group. Conclusions: Participants with proven good clinical health subjected to a low plastic exposure intervention period of 7 days did not alter a broad range of clinical health markers, compared to control participants. We suggest that further intervention studies be conducted on participants with underlying disease associated changes, conducted over a longer intervention period, to assess the underlying influence of plastic associated chemicals, on such disease associated changes.

69. Influences of size, concentration, polymer and exposure time on nanoplastic toxicity within the kidney

- Hayden Gillings

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Nanoplastics (NPs) are plastic particles ≤100 nm in size, often generated through plastic waste degradation. Despite their environmental prevalence, knowledge of NP exposure effects on renal health remains limited. This study investigated how variations in NP polymer, size, concentration and exposure time impacts human kidney proximal tubule (HK-2) cells and C57BL6/J mice. HK-2 cells were exposed to 0.2-200 µg/mL of polystyrene (PS), polyethylene and poly(methyl methacrylate) NPs ranging from 15-100 nm for 24-hours to assess polymer, size and concentration dependent effects of NP exposure, assessing for NP internalisation, cell viability and cell cycle disruption. Long-term, repeated NP exposure was assessed by culturing HK-2 cells in media containing 100 µg/mL of 20 nm and 100 nm PS NPs for 12 days, collecting and reseeding cells every 3 days. Treatment ceased at days 9 and 12 for the respective 20 nm and 100 nm NP groups due to low cell growth. RNA-sequencing was performed, followed by differential gene expression (DGE) and gene enrichment pathway analyses. In animal studies C57BL6/J mice (n=10/group) were given drinking water containing 20 nm and 100 nm spherical PS NPs at a concentration of 100 µg/mL, and lab-made non-spherical ≤100 nm PS NPs (2.6x107 particles/mL). Mice were monitored for weight and water intake. Serum, urine and tissue samples were collected at 28 days exposure. Short-term treatment showed significant changes in viability at high NP concentrations, with clear indicators of polymeric influence, while smaller NP sizes affected cell cycle. Long-term experiments demonstrated significant increases in DGE at 6 (1,548) and 9 days (4,431) of repeated exposure in the 20 nm group, while the 100 nm group saw a DGE increase at day 9 (35). Both groups expressed significant upregulation of genes and pathways linked to inflammation, cell dysregulation and apoptosis – which have mechanistic links to fibrosis, kidney injury and kidney disease. Animal studies did not show any major changes between the control and treatment groups, however the lab-made NP group showed a trend of lower body weights, water intake, and pathological kidney function markers. NPs trigger size- and polymer-dependent stress responses in kidney cells, activating pathways linked to renal injury. Though in vivo effects were minimal, transcriptomic changes suggest early molecular disturbances that may precede kidney dysfunction, highlighting NPs as an emerging renal risk factor.

70. Uptake and Elimination of Microplastics by Tetrahymena Thermophila Using Flow Cytometric Analysis - Yquan Liu, Guangbo Qu, Guibin Jiang

Yquan Liu[1], Guibin Jiang[1]

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Understanding the fate and impacts of microplastics (MPs) on foundational organisms within food webs is crucial for accurately assessing their toxicity and environmental risks. quantifying absolute cellular uptake at the single-cell level using high-throughput methods remains a significant challenge. In this study, we developed a flow cytometry-based approach that integrates a particle balance method with biokinetic modeling to quantitatively assess the uptake and elimination dynamics of fluorescently labeled MPs in the freshwater ciliate Tetrahymena thermophila. Intracellular MP accumulation was determined by subtracting the extracellular particle content from the total exposure amount, effectively eliminating interference from fluorescence quenching and cellular background signals. Our results showed that intracellular MP levels increased steadily during the first hour of exposure, followed by a marked decline within 24 hours. Through biokinetic modeling, we found that the effect of cell division on reducing MP burden was higher than that of direct elimination, depending on the exposure concentration. Our results indicated a strong potential for MP bioaccumulation in T. thermophila.

71. Particles, chemicals or both: Plastic additive chemicals in hazard assessment of micro- and nanoplastic - Andy Booth

Andy Booth[1], Lisbet Sørensen[1,2], Bjørn Henrik Hansen[1], Amaia Igartua[1], Tania Gomes[3], Stefania Piarulli[1]

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Micro- and nanoplastics (MNPs) are pervasive environmental pollutants with increasing evidence of harmful effects. While traditional hazard assessments have focused on size, shape, and polymer type, plastic additives are now recognized as significant contributors to MNP toxicity. Over 16,000 plastic-associated chemicals—including plasticizers, stabilizers, flame retardants, and colorants—have been used globally. These additives are not chemically bound to the polymer and can leach into water and biological fluids, influenced by polymer and chemical properties and environmental or biological conditions. Additive composition varies widely across polymer types and consumer products, and many additives lack thorough toxicological data. Despite their importance, most MNP hazard assessments rely on poorly characterized or additive-free materials, limiting their ecological, biological, and regulatory relevance. The current study presents a study of 50 consumer products and investigates the toxicity of their leachates to simple organisms, looking at how product type and polymer composition influenced the toxicity. Different extraction methods were compared for their ability to accurately characterize the additive chemical profile of the 50 consumer products, indicating strong differences and just 19 common chemicals identified by all 3 methods. Next, the composition of natural water leachates of four select elastomers (including car tyre rubber) was investigated to gain a deeper understanding of the extrinsic environmental properties driving leaching. The number of chemical features in leachates was generally similar to the corresponding chemical extracts, but strong differences in relative composition were detected. Particle loading, temperature, salinity and leaching time all influenced leachate composition. Finally, we investigated the relative importance of particle and chemical driven toxicity using car tyre rubber and Atlantic cod embryo exposures with leachate-only, particle-only and combined particle and leachate exposures, assessing hazard using a range of toxicological endpoints, including mortality, hatching success, developmental abnormalities and gene expression. While car tyre chemicals were the primary driver of toxicity, the physical particles may enhance effects. There is a critical need for producing and utilizing test and reference materials in hazard assessment that identifies the drivers of environmental and human health hazards.

72. Characterization of the composition of chemical additives in plastics
- Guangbo Qu

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Cumulative global plastic production is projected to reach 34 billion metric tons by 2050, underscoring its role as a major pathway for chemical exposure to humans and the environment. These substances, incorporated primarily through physical blending, are released throughout the plastic life cycle. Although research is increasingly focusing on plastic additives and their hazards like endocrine disruption, critical knowledge gaps persist. This study therefore aims to (1) characterize the composition of chemical additives in plastics; (2) elucidate their distribution across polymer types and product uses; and (3) evaluate multi-target biological effects to identify previously unknown critical compounds. Based on non-targeted analysis, 121 chemical additives were identified in 35 plastic products, including 107 confidence level 1 (CL1) and 14 CL2 compounds. Significant differences in chemical additive profiles were observed across polymer types, with polyvinyl chloride (PVC) products generally containing the highest overall additive concentrations. Among product categories, furniture and household items exhibited elevated additive levels, with PVC flooring showing the highest concentration. A comparative analysis between biodegradable and conventional plastics revealed notable differences in total additive content between flexible and rigid materials, likely reflecting performance requirements in different applications. Specifically, flexible biodegradable plastics contained lower additive levels than their conventional counterparts, whereas the opposite trend was observed in rigid materials. Multi-endpoint bioassays were employed to evaluate the biological effects of plastic extracts. These included cytotoxicity assessments in human MIHA hepatocytes and HEK293T embryonic kidney cells, aquatic toxicity tests using Chlorella, Tetrahymena, and zebrafish embryos, as well as estrogen receptor and androgen receptor activation and antagonism assays. The sensitivity varied across endpoints, and biodegradable plastics demonstrated biological effects comparable to or even stronger than those of conventional plastics. Furthermore, endocrine disruption potential was identified for several additives, with previously unreported activity observed for compounds such as BDPA and DPPD-quinone.

73. Effects of Dietary Microplastic and Nanoplastic Exposure on the Murine Gut Microbiota: A Narrative Review
- Madoka Lelliott

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Background: Micro- and nanoplastics (MNPs) are an emerging environmental concern, with increasing evidence of potential impacts on the gut microbiota, such as promoting dysbiosis. Mouse models are widely used to investigate gut microbiota responses due to their physiological similarities to humans and the ability to control environmental and genetic variables. However, findings across existing studies remain inconsistent. Objective: We aimed to review and synthesise mouse studies investigating the effects of MNPs exposure on gut microbiota diversity, composition, and intestinal function to uncover critical research gaps and highlight future investigative priorities. Methods: A targeted literature search was conducted on peer-review publications up to October 2025. Eligible studies included mouse models exposed to MNPs with microbiome-related outcomes. Primary outcomes were microbiota diversity, taxonomic composition. Secondary outcomes were gut permeability, inflammatory, and oxidative stress markers. Experimental conditions were also extracted. Planned subgroup analyses will explore the influence of particle characteristics, exposure duration and dose, and study quality. Results: Sixty-nine studies have met inclusion criteria. The majority of studies (n=51) used polystyrene particles and reported micron-sized plastics (> 1 µm; median size: 5 µm). Notably, important metrics for exposure assessment such as particle counts or surface area of the particle, were rarely reported (n=1). There were no consistent associations between MNPs exposure and alpha-diversity or individual taxa abundance. However, MNPs exposure was more frequently linked with changes in beta-diversity and physiological alterations, including increased gut permeability (e.g., Claudin-1, Occludin, ZO-1), inflammatory responses (e.g., IL-1β, IL-6, TNF-α) and oxidative stress (e.g., GSH, MDA, ROS, SOD). Experimental conditions differed across studies, particularly in exposure routes, while reporting on housing and environmental conditions was often lacking, limiting assessment of background exposure. Conclusion: This review synthesises current experimental evidence on the effects of MNPs exposure on the gut microbiota in mouse models. The findings highlight the need for improved experimental design, including clearer reporting, standardized methodologies, and the use of MNPs that better reflect environmental conditions.

74. Detection and identification of microplastics in commercial seafood: a preliminary result for human health considerations

- Khamsiah Achmad

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Small and large quantities of microplastics (MPs) have been detected in marine pelagic and filter-feeding organisms. This issue is of concern for food safety for human consumers. In this study, MP particles were assessed in commercial fish and bivalve species obtained from local markets in Ternate, eastern Indonesia. Triplicates of 14 species were studied, including skipjack (Katsuwonus pelamis), Tuna (Thunnus sp), Indian scad (Decapterus ruselli), Marine ray-finned fish (Caesio sp), Sardine (Sardinella longiceps), Giant trevally (Caranx ignobilis), Snapper (Lutjanus synagris), Rock oyster (Cellana testudinaria and Patella flexuosa), Blood clam (Anadara granosa), Saltwater clam Meretrix (Veneridae), Giant clam (Tridacna gigas), Pen shell (Penna sp), Asian clam (Corbicula sp), and Scallop (Pectinidae). MP filament, fragment, and film were identified from the tissues and gastrointestinal tract of 90% of organisms tested. MP abundance ranged from 1 to 6 items per gram wet weight of body tissue (items/g w.w) with different colours (from white/transparent to yellow, orange, pink/red, green, and black). Fragments were most abundant in the Giant trevally sample (5 items/g w.w), and filaments were most abundant in the Blood clam sample (2 items/g w.w). Black MPs were most common in fish species (35%), while white/transparent MPs were more common in bivalve species (37%). This study reveals that MP contamination is present in widely consumed fish and bivalves and emphasises the significant pathway of human exposure through seafood consumption. It may be a ramification for human health and food security. Keywords: microplastics, commercial seafood, abundance, morphotype, colour.

75. Unravelling the causal link between dietary bisphenol exposure and female infertility; creating an 'ideal' mouse exposure model

- Alexandra Peters

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We are amidst a global fertility crisis, with 1 in 6 people experiencing infertility and an increasing reliance on assisted reproductive technologies. Bisphenols, including bisphenol A (BPA) and increasingly popular BPA alternatives (BPS and BPF) are chemicals in food and drink packaging that contaminate what we consume, posing serious risks to human health, including fertility. Concerningly, in Australia, bisphenols in food and drink packaging are minimally regulated, with the 'safe' daily intake for BPA set 250,000 times higher than in Europe. Recently, we evaluated evidence from 107 studies examining bisphenol effects on female fertility, focusing on egg health. Eggs, in the ovary, are among the longest-lived cells in the human body and susceptible to repeated damage from bisphenol exposure. Our study highlighted overwhelming evidence of harm to egg health from bisphenol exposure at current 'safe' levels, however, many studies had design limitations preventing their ability to influence regulations. To address this, we aim to assess the causal effect of dietary BPA, BPS, and BPF exposure on female fertility and egg health in a rigorously controlled in vivo mouse model. Sexually mature, ~8-week-old Swiss mice will receive BPA, BPS, or BPF in drinking water for four weeks at doses relevant to globally applicable 'safe' exposure limits including 0.2 ng, 4 µg, 0.05 mg/kg bw/day, or pure RO water (control). Prior to exposure, mice will undergo a 2-week "wash-out period" in a modified low-plastic, low-phytoestrogen environment to minimise exposure to bisphenols and other contaminants. At the conclusion of exposure, ovaries will be collected alongside various body organs for the assessment of five key egg health parameters. These include follicle counts of ovarian sections, and egg yield, morphology, developmental capacity (meiotic maturation), and metaphase spindle alignment for n=10 biological replicates per dose. The BPA exposure model is currently underway and assessment of these parameters will soon begin. Through this work, we seek to promote standardisation of dietary in vivo exposure modelling and provide an ideal template for reproductive toxicology studies, generating high-quality evidence to provide a causal link between dietary bisphenol exposure and female infertility. Ultimately, this research will help inform revision of safe bisphenol exposure guidelines, improving the health and fertility of current and future generations.

76. Hazard identification and characterization of leachable chemicals from plastic products – a new PARC project

- Hubert Dirven

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The PlastChem study has suggested that plastics may contain more than 16,000 chemicals, including additives, processing aids, starting substances, intermediates and Non-Intentionally Added Substances (NIASs). Plastic chemicals are released throughout the plastic life cycle, from production, use, disposal and recycling. Most of these chemicals have not been studied for potential hazardous properties for humans and in the environment. To carry out reliable risk assessment of these potential leachable chemicals for human health and the environment, additional hazard data are needed. The PlasticLeach project within the EU co-funded Partnership for the Assessment of Risks from Chemicals (PARC) aims to address this data gap by screening several plastic products covering different polymers, including fossil-fuel, biobased and biodegradable plastics. Several items will be sampled and leachates will be prepared with methanol extraction. The obtained chemical mixtures will be further characterized and tested for their toxicity using selected guideline compliant assays and New Approach Methods (NAMs), covering both human health and ecotoxicity endpoints. The endpoints will include cytotoxicity, endocrine disruption, genotoxicity, immunotoxicity, reproductive toxicity and effects related to ecotoxicity. The most toxic leachates will be characterized using a non-targeted analysis pipeline to identify chemicals in the leachate. When single chemicals of concern are identified, these will be further tested to determine hazardous properties and identify the respective relative potency factors to better understand their specific hazard profiles. A tiered approach for hazard testing will be followed. The experimental work will be complemented by in silico toxicological profiling, using publicly available toxicity databases and tools that cover both human and environmental endpoints. Data generated from in silico, in vitro, and in vivo approaches will be reported using standardized formats, stored within a centralized repository, and harmonized to adhere to the FAIR (Findable, Accessible, Interoperable, and Reusable) data principles. This integrated strategy will not only advance our understanding of the risks associated with plastic-derived chemicals but will also provide critical support for regulatory decision-making and facilitate the development of safer, and more environmentally and ecofriendly plastic materials in the future.

77. Evaluating the Blood–Brain Barrier Permeability of Organophosphate Flame Retardants (OPFRs) Using an In Vitro Model

- Marta Lopez

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Organophosphate flame retardants (OPFRs) are a class of chemical compounds widely used as flame retardants and plasticizers in products such as furniture, electronics, and construction materials. Their use increased after being introduced as an alternative to brominated flame retardants, which had been progressively banned due to their environmental persistence and toxicity. As a result, OPFRs are now ubiquitously detected in the environment as well as in human and non-human biota. Emerging evidence suggests that certain OPFRs may have potential neurotoxic effects. However, data on blood-brain barrier (BBB) penetration of these compounds are limited, with critical gaps in addressing the role of direct brain exposure in potential pathways of impact on the central nervous system (CNS) and therefore informing relative risk from exposure across this chemical class. The objective of this study is to determine the permeability of the BBB to different OPFRs, including triethyl phosphate (TEP), tributyl phosphate (TBP), tris(2-chloroisopropyl) phosphate (TCPP) and tris(2-ethylhexyl) phosphate (TEHP), across the BBB. This approach aims to relate their permeability to chemical properties, such as molecular size or lipophilicity, in an attempt to identify factors that might affect their passage and inform the risk these compounds may pose to the CNS through direct brain exposure. The human cerebral microvascular endothelial cell line (hCMEC/D3), a well-established in vitro model of the BBB, will be exposed to different concentrations of OPFRs. This cell line expresses multiple brain endothelial markers, tight junctions and adherens junctions, as well as functional membrane transporters typical of brain endothelium. It is frequently used for drug transport studies and to evaluate the effects of xenobiotics on brain endothelial cells. Here, we present an experimental framework to assess the effects of the selected OPFRs, consisting in two main assays. First, the cytotoxicity of the compounds will be tested to determine their effect on endothelial cell viability. Next, their permeability will be determined using a Transwell assay, with measurements of transendothelial electrical resistance (TEER) to monitor the BBB integrity. In addition, reference drugs with known permeability will be included as tracers. This project will contribute to understanding which OPFRs may reach the CNS and help guide future research on their potential neurotoxic effects.

78. Particulate toxicity of microplastics leads to a shift in the reproductive strategy of Oryzias melastigma: from an r- to a K-strategy

- Xiaoshan Zhu

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Transgenerational toxicity has been a major focus of microplastic toxicology in recent years. Once ingested by organisms, microplastics (MPs) tend to release plastic additives in the digestive tract, forming microplastic leachates (MLs). Most MLs are endocrine disruptors and can also cause transgenerational toxicity in organisms. However, it remains unclear whether the transgenerational toxicity of MPs is caused by MP particles or MLs. In this study, we exposed Oryzias melastigma to fluorescent MPs in aqueous phase and/or food phase. The results showed that food phase MPs are the dominating sources of MPs in fish. Then O. melastigma were exposed to food phase polystyrene MPs (PS-MPs), additive-free PS-MPs and ML (dimethyl phthalate, DMP) at different concentrations (0.75 and 75 ug/mg MPs in fish food; 4.5 ng/g and 0.49 µg/g DMP in fish food), revealing the contribution of MPs or MLs to transgenerational toxicity and the reproductive strategy of fish under different exposure conditions. The transgenerational toxicity of PS-MPs at both high and low exposure conditions was mainly caused by MPs rather than ML (DMP). Furthermore, under high exposure conditions, the particulate toxicity of PS-MPs leads to a shift in the reproductive strategy of fish from an r- (high fecundity, low hatching rate, high deformity rate and low-quality offspring) to a K-strategy (low fecundity, high hatching rate, low deformity rate and high-quality offspring). To compare the effects of environmental aging on the transgenerational toxicity of PS-MPs and polylactic acid MPs (PLA-MPs), aged PLA-MPs and PS-MPs were used to expose fish. The results showed that the transgenerational toxicity of MPs to fish was mainly related to the exposure concentrations of MPs, but less to the materials and aging conditions of MPs. Our studies provide critical knowledge for the environmental risk assessment of MPs and plastic additives.

79. Microplastics along Victoria's coastline: composition, abundance, and metal sorption potential

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Microplastics (MPs) are emerging contaminants of global concern due to their small size, low density, and high mobility within aquatic systems. Their physicochemical properties enable widespread distribution across surface waters, sediments, and biota, influencing their ecological behaviour, toxicity, and potential to transport co-contaminants. This study examined the distribution, composition, and metal-binding potential of MPs across water, sediment, and biota (blue mussels and limpets) along Victoria's coastline, Australia. Samples collected from four coastal sites were analysed for MP morphology using a Satura imaging system, polymer composition via ATR-FTIR, and associated trace metals through ICP-MS. Seven polymer types were identified, with fibres dominating water (72%) and sediment (65%), while fragments prevailed in biota (48%). Mean MP abundances were 103.8 ± 21.5 items/L (water), 33.12 ± 9.7 items/g (sediment), and 4.2 ± 2.4 items/individual (biota). Polystyrene (PS) and polyethylene (PE) were the most abundant polymers, particularly in sediments, and exhibited high sorption of Cr, Ni, Zn, and Al, with the highest metal load observed at Eastern Beach, a site influenced by stormwater discharge and recreational activity. No consistent relationship was found between MP size and metal concentration. These findings highlight the role of MPs especially PS and PE as vectors for trace metals in coastal ecosystems and underscore their dual threat as physical pollutants and chemical carriers. This study provides critical baseline data for developing integrated coastal management and pollution mitigation strategies in human-impacted marine environments.

80. Microplastics reshape soil microbial networks and nitrogen cycling: contrasting impacts of conventional and biodegradable types

- Hongwen Sun

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Biodegradable microplastics (MPs) are proposed as sustainable alternatives to conventional MPs, yet their distinct effects on soil microbial communities and ecological functions remain insufficiently understood. This study compares the impacts of biodegradable polylactic acid (PLA) and conventional polyvinyl chloride (PVC) MPs on soil microbial assemblages and nitrogen cycling. Fluorescein diacetate hydrolase (FDAse) activity was temporarily stimulated by 2% (w/w) PLA and PVC MPs, while 7% (w/w) PVC MPs initially inhibited FDAse activity before promoting it. PLA MPs (2% and 7%, w/w) dramatically reduced bacterial diversity and altered community structure, enriching genera such as Nocardioides, Arthrobacter, Agromyces, Amycolatopsis, Saccharothrix, and Ramlibacter, known for degrading complex compounds. Conversely, PVC MPs (2% and 7%, w/w) showed minimal influence on bacterial diversity, with only temporary structural shifts at high concentrations (7% w/w). Network analysis revealed greater microbial complexity with PLA MPs, where MPs-degrading taxa emerged as keystone species. PLA MPs at both concentrations notably increased the abundance of nitrogenase iron protein subunit H gene (nifH) and nitrogen-fixing bacteria, such as Bradyrhizobium, while also sustaining ammonia monooxygenase subunit A gene (AOB amoA) effects up to day 90. At higher doses (7% w/w), PLA MPs enriched copper-containing nitrite reductase gene (nirK) and cytochrome cd1 nitrite reductase gene (nirS) abundance, boosting denitrifiers like Cupriavidus, Pseudarthrobacter, and Ensifer. In contrast, PVC MPs showed short-term effects on nitrogen cycling function. These findings have important implications for promoting sustainable agriculture and managing the environmental risks posed by MPs in soil ecosystems.

81. Reproductive Effects of Phthalates and Microplastics on Marine Mussels Based on Adverse Outcome Pathway

- Xukai Lan

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Microplastic pollution has emerged as a global environmental concern. As filter-feeding organisms, marine mussels are particularly vulnerable to microplastics. Moreover, phthalic acid esters (PAEs) are known to leach from microplastics under various environmental conditions. Among PAEs, bis(2-ethylhexyl) phthalate (DEHP) is a common endocrine disruptor. We investigated the effects of microplastics and plasticizers on the reproductive function of the female mussel Mytilus coruscus. The results revealed that environmental exposure to DEHP and high-density polyethylene (HDPE) triggered molecular changes by allowing DEHP to act as an antiestrogen by binding with estrogen receptors (ER), thereby constituting the molecular initiating event. Key events were the suppression of ER, cytochrome P450–3 (CYP3), and 17β-hydroxysteroid dehydrogenase (17β-HSD) gene expressions, which reduced estradiol and progesterone levels in ovarian tissues. Ultimately adverse outcomes occurred: antioxidant capacity in ovarian tissue was impaired, hindering ovarian development and reducing reproductive function. This study introduces a novel adverse outcome pathway (AOP) framework focusing on reproductive impairment in shellfish. By integrating experimental findings with the AOP concept, the research provides essential data for understanding the toxicological effects of microplastic pollutants on mussels. This framework offers valuable insights for risk assessment, contributing to a better understanding of how microplastics and plasticizers threaten marine life.

82. Quantitative Analysis and Identification of Micro and Nanoplastics in the Hemisphere of a Human Brain

- Marcus Garcia

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The ubiquitous presence of micro- and nanoplastics (MNPs) brings concern for environmental and human health conditions. While MNPs have been observed and categorized throughout the body, no studies have successfully mapped and quantified the specific accumulation and distribution of MNPs within singular organs. This study focuses on MNPs found in the human brain, specifically the right cerebral hemisphere's white and grey matter. This area includes the olfactory, optic, cranial nerves, cerebral artery, corpus colosseum, basal ganglia, hippocampus, occipital cortex, medulla, pons, cerebellum, and brainstem. For analysis, autopsy samples were obtained in 2024 from the Office of the Medical Investigator in Albuquerque, New Mexico. Using a digestion protocol and Pyrolysis Gas Chromatography/ Mass Spectrometry (Py-GC/MS), results showed the highest average concentration of MNPs in the white matter (WM) (3605 ug/g). In contrast, the grey matter (GM) (1,485ug/g), arteries, and nerves (2,501ug/g) showed a significantly lower concentration. Of the 12 polymers scr eened for, polyethylene (PE) showed the highest prevalence (WM:1178ug/g, GM:512ug/g), followed by polypropylene (PP) (WM:1079ug/g, GM:344ug/g) polyethylene terephthalate (PET) (WM:225ug/g, GM:86ug/g), and polyvinyl chloride (PVC) (WM:216ug/g, GM:87ug/g), in the basilar artery (PE: 2111µg/g, PP: 781.37µg/g), pituitary (PE: 44.54ug/g, PP: 56µg/g), and cranial nerves (PE: 2413ug/g, PP: 290ug/g). These findings highlight the potential implications of MNP accumulation on brain function and overall health. By enhancing the detection sensitivity for 12 distinct polymers in brain tissue, this research contributes to a more comprehensive understanding and map of MNP accumulation on brain function and overall health. As we further investigate MNPs in other organs, such research could reveal critical links between MNP accumulation and specific diseases. Additionally, it opens up new avenues for exploring environmental and health policies to mitigate the effects of MNPs on human health. Future studies may examine correlations between MNP buildup and disease, helping to uncover possible connections between plastic accumulation and a wide range of health conditions.

83. Evaluating the Biological Safety of Water Stored in PET Bottles: A Sub Chronic Rodent Study

- Prabhu Darshan

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Objective: This study aimed to evaluate the biological safety of water stored in polyethylene terephthalate (PET) containers under varying standard storage conditions by investigating potential chemical migration, systemic toxicity, and associated biochemical or molecular alterations in a sub-chronic rodent model. Methodology: A 90-day repeated-dose oral exposure study was carried out in Wistar rats in accordance with the OECD Test Guideline 408 for sub-chronic toxicity assessment. Water was stored in PET bottles at room temperature, 40°C, and 60°C for 60, 30 and 10 days, respectively. The basis of the standards used for the storage conditions was IS-15410:2018, IS 9845, and EU 10/2011. After the completion of the storage period, the water was transferred to clean glass bottles and given to experimental male and female rats as drinking water for the rest of the study. Growth and morphological characteristics were observed. To assess systemic responses, Blood and tissue samples were examined for haematology, histopathology, endocrine markers, biochemical and enzymatic profiles in each group. Pyrolysis–gas chromatography–mass spectrometry (Py–GC–MS) was utilized to detect and identify potential leachates from PET bottles. Results and Conclusion: No significant variations were observed between the control and PET-water groups of either male or female rats in any physiological, biochemical, or molecular parameters, and the Py–GC–MS analysis confirmed that potential leachates were within regulatory safety limits. Collectively, these findings suggest that water stored in PET bottles remains biologically safe under standard storage conditions, supporting its continued and regulated use in food contact applications.

84. Microplastics: Towards understanding their environmental effects and forward thinking towards more safe and sustainable solutions

- George Vamvounis

George Vamvounis[1]

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Plastic pollution, including microplastics, presents a significant threat to aquatic ecosystems and wildlife. Experiments measuring microplastic toxicity often use microplastic particles recovered from the environment. In this seminar, I will discuss a controlled approach in which microplastics are produced with a known composition. This method was used to incorporate various additives into polyvinyl chloride (PVC)1 and polystyrene2 microplastics. The diffusion of the additives from the microplastics under various conditions (temperature, agitation, salinity, microplastic size) was studied to understand the effect of environmental factors on additive diffusion (Figure 1).3-4 The implications of leaching on the marine environment will be discussed, and safer, more sustainable alternatives will be presented.

85. Hidden Microbial Reefs Attached to Plastics can Harbour Pathogenic and Drug-resistant Organisms

- Emily May Stevenson

Emily May Stevenson[1], Angus Buckling[1], Matthew Cole[2], Pennie Lindeque[2], Aimee Kaye Murray[1]

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Over 100 trillion microplastic particles are estimated to be floating in the global ocean, yet their implication for ecosystem and human health remain poorly understood. Beyond physical ingestion and chemical toxicity, microplastics act as novel surfaces for microbial colonisation, forming distinct biofilm communities known as the 'Plastisphere'. However, it remains unclear how polymer properties and environmental conditions influence microbial selection and the potential enrichment of antimicrobial resistant (AMR) or pathogenic bacteria within these communities. This research integrates in vitro, in situ and in vivo experiments to investigate how microplastics may contribute to the persistence and spread of AMR. Using polyethylene, polypropylene and polystyrene alongside natural (wood), inert (glass) and free-living (water) controls, we assessed selective colonisation and AMR enrichment across environments. Laboratory experiments revealed polymer-specific community structures, with wood and polystyrene supporting higher AMR potential, and sewage-derived bio-beads hosting pathogenic taxa. Sterilised particles were then deployed for two months across four aquatic environments, from hospital wastewater to offshore marine waters. Following incubation, biofilms and water samples underwent DNA extraction and whole metagenome sequencing. From this, polystyrene was again highlighted to serve as a reservoir for AMR, and the environment significantly influenced community composition and resistome. An exposure assay was then conducted to assess the role of microfibres as vectors for AMR pathogens within the food chain, finding exposure to microfibres selected for AMR in vivo. These collective findings demonstrate that both polymer type and environment can significantly influence AMR gene enrichment, suggesting certain plastics act as long-term microbial reservoirs with human health relevance. Altogether, this work underscores how microplastics represent not just a chemical pollutant, but a biological vector with implications for environmental and human health.

86. Prenatal exposure to a phthalate mixture increases internalising problems in early childhood partly via maternal oxidative stress

- Sarah Thomson

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Prenatal phthalate exposure has been linked to internalising problems in children. Maternal oxidative stress is a plausible biological mechanism underlying this association as it is induced by phthalates and is associated with early internalising problems, but empirical evidence evaluating this pathway is lacking. In the Barwon Infant Study, a population-based birth cohort of 1,074 Australian children, we investigated the potential mixture effect of prenatal phthalate exposure on maternal oxidative stress. We then assessed whether oxidative stress mediates the relationship between prenatal phthalate mixture exposure and early internalising problems. Concentrations of phthalate metabolites and nucleic acid oxidation biomarkers were measured in third-trimester maternal urine, and phthalate daily intakes estimated. Internalising problems were assessed at ages two and four years using the parent-report Child Behavior Checklist and Strengths and Difficulties Questionnaire, respectively. Applying weighted quantile sum regression with repeated holdout validation, we found that higher phthalate mixture exposure was associated with increased maternal oxidative stress (0.22 standard deviations per interquartile range increase in mixture, 95% CI: 0.13, 0.31), with dimethyl phthalate and diethyl phthalate as main contributors. Bayesian kernel machine regression yielded comparable results. For all child outcomes, counterfactual mediation analyses across holdout datasets revealed evidence of mediating effects, suggesting that oxidative stress is a pathway through which prenatal phthalate mixture exposure increases early-childhood internalising problems. These findings highlight the heightened risk associated with co-exposure to multiple phthalates during pregnancy and the potential to mitigate this harm not only through improved chemical regulation but also by monitoring and reducing maternal oxidative stress.

87. What risks do dietary bisphenol exposures pose to female fertility?
- Jessie Sutherland

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Globally, assisted reproductive technology uptake has skyrocketed, with 1 in 6 people now experiencing infertility. In Australia, over 60% of infertility cases in 2023 were attributed to an underlying female factor, with a further 25% categorised as 'unexplained'. Female reproductive ageing, linked to declining oocyte (egg) quantity and quality, is increasingly associated with unexplained infertility. This decline is accelerated by environmental exposures to toxicants, including plastic chemicals such as bisphenols. Bisphenols are used in plastics and epoxy resins found in food and beverage containers and are known to leach into consumables and our diet, raising major health concerns. Human oocytes, among the longest-lived cells in the body, are particularly vulnerable to repeated and cumulative bisphenol exposure, with potential consequences for future generations. In Australia, bisphenol regulation is limited to bisphenol A (BPA), with outdated tolerable daily limits and no regulation for emerging alternatives or regrettable substitutes such as bisphenol S and F (BPS; BPF). There is an urgent need to understand the risks bisphenols pose to oocyte decline and female infertility to inform new exposure guidelines. To investigate associations between diet, bisphenol exposure, and fertility outcomes, we will study a cohort of Australian women (N=260) undergoing fertility treatment and oocyte collection. Bisphenol analysis (BPA, BPS, BPF) will be conducted via liquid chromatography with tandem mass spectrometry (LC-MS/MS; Sciex7500) on seven urine samples and one follicular fluid sample corresponding to four unique time points across the participants hormone stimulation cycle. Participants will also complete a dietary survey to identify modifiable exposure risks. Regression analysis will assess associations between bisphenol levels and fertility outcomes including oocyte yield, fertilisation rate, clinical pregnancy, and live birth. This will be the first Australian study to directly evaluate BPA, BPS, and BPF exposures to fertility treatment outcomes in people with female infertility. These findings will inform clinical practice and guidelines including how to identify and reduce harmful bisphenol exposure in the preconception period.

88. You are What you Eat: Determining Microplastic Risk in Australian Agricultural Systems
- Scott Wilson

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Plastic use in agricultural systems is a common and widespread practice across the world. Processes such as mulching, weed suppression, irrigation, and fertilizer distribution amongst others are regular practices dominated by plastics. These however have the potential to release or distribute microplastics that contaminate soils and crops. Understanding the risks they pose to primary production is critical in informed decision making to better manage the issue. In Australia however, data on microplastics in agricultural environments is sparse so to understand the potential problems a risk-based model was developed to predict areas of concern and food systems at risk. Utilising data on plastic use from different farming systems and crop type, literature on soil parameters that can affect microplastic retention and crop uptake, plus rainfall patterns and catchment characteristics, a microplastic risk model for major cropping systems in Australia was established. This paper will explore sources, fate and transport of microplastic in these systems and the implications for the associated food systems and potential human exposure.

89. Inhalable Microplastics as Vectors of Co-Contaminants and Their Associated Health Risks
- Abhishek Biswas

Abhishek Biswas[1], Nirupama Saini[3], Nikhil Chivukula[4,5], Areejit Samal[4,5], Mahesh Ravikumar Jansari[6], Punyasloke Bhadury[2,3], Gopala Krishna Darbha*[1,2]

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This study reveals the levels of inhalable microplastics (iMPs, < 10 µm) and, for the first time, comprehensively investigates their role as carriers of co-contaminants. The samples were collected at human breathing height (~1.5m) from the urban markets of four megacities in India (Delhi, Mumbai, Chennai, and Kolkata), which are among the most crowded and polluted. The quantitative and qualitative detection of iMPs was estimated using Pyrolysis Gas Chromatography-Mass Spectrometry and micro-Raman, respectively. To simulate a person slowly walking through the market, active sampling was conducted using a cascade impactor set to an inhalation rate of 9L/min. The research found that around 9 µg/m3 of iMPs will be inhaled by the residents and daily commuters of these cities. The Lifetime lung load of AMPs approaches 3 grams per person in urban spaces of India. Also, the levels of particulate matter 10 & 2.5 were found to be approximately 6 to 11 times higher (~290 µg/m3) than the WHO's guidelines. Apart from estimating the levels of iMPs, this comprehensive research tries to delineate hidden risks associated with the inhalation of iMPs. Additionally, based on morphological characters and libraries, their probable source apportionment was done. Our extensive findings also reveal AMPs role as carriers of various pollutants such as microbes, toxic metals, endocrine disruptors, etc. Numerous bacterial and fungal strains were detected in iMPs samples collected during the mass gatherings (festivals), highlighting their role as carriers of these pathogens. Along with a new bacterial strain, numerous other bacteria were detected. More than 20 species of fungi were found laden to the surface of iMPs, including a few pathogenic immunosuppressing fungal species such as Candida and Aspergillus. The detection of antibiotic resistance genes (multidrug resistance) and virulence factor genes in the iMPs-attached bacterial strains also intensifies the problems. Furthermore, their role in the incidence of diseases when burned unintentionally in an open dumping site is explored. Various up-to-date toxicological databases linked these emitted chemicals with cancer, gut, respiratory, breast, and endocrine-like diseases.

90. Microplastics and increased risk of early-stage bowel disease
- Krista Dawson

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Background Rising rates of early-onset colorectal cancer underscore the need to better characterise modifiable and environmental risk factors. The detection of microplastics within human colonic tissue suggests that their accumulation may contribute to cellular alterations associated with early-stage disease. This study aims to evaluate potential associations between microplastic burden and early indicators of colorectal cancer. Methods Three anatomically matched proximal and distal colonic biopsies were collected from consenting participants undergoing routine colonoscopy. Histological assessment was used to stratify participants into a healthy control group (n=20) and an adenoma group comprising individuals with lesions >0.5 cm (n=20). Microplastic burden was quantified through alkaline digestion of tissues followed by vacuum-assisted filtration through 1 µm cellulose filters, enabling determination of microplastic mass per gram of tissue at each anatomical site. A second matched biopsy pair (proximal and distal) was formalin-fixed, paraffin-embedded, and sectioned. Immunofluorescent microscopy was used to detect DNA damage (γ-H2AX), with Z-stack imaging used to quantify the extent of cellular damage. RNA was extracted from the remaining biopsy pair and reverse-transcribed into cDNA prior to quantitative PCR analysis of targeted pathways, including DNA damage responses, inflammatory signalling, and epithelial adhesion genes such as CDH1 (encoding E-cadherin). Microplastic burden will be statistically correlated with these histological and transcriptional endpoints, as well as clinical indicators of disease state, including adenoma size and anatomical location. Results Data outlining the development and optimisation of these targeted assays will be presented, together with preliminary findings. Conclusion Although microplastic exposure is inevitable, defining their biological effects within the human colon, particularly in the context of colorectal cancer, represents a critical first step toward mitigating both individual and, more broadly, environmental risk.

91. Risk assessment of micro- and nanoplastics for early-life human health: the AURORA Horizon 2020 research project
- Roel Vermeulen

Roel Vermeulen[1,2], Amanda Durkin[1,2], Runyu Zou[1,2], on behalf of the AURORA project consortium

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The scale of micro- and nanoplastic (MNP) pollution is becoming increasingly evident, yet little is known about its effects on human health, particularly during early life. MNPs, plastic particles smaller than 1 mm, are now routinely detected in human tissues and biofluids, including stool, blood, breastmilk, and placenta. The AURORA project investigates early-life risks of MNP exposure. To this end, AURORA has developed both in-depth analytical methods (microscopy and spectroscopy) to characterize the level and morphology of MNPs in biological matrices, and high-throughput mass-spectrometry methods to quantify MNP mass for a broad range of polymers (PMMA, N66, PP, SBR, PE, PVC, N6, PC, PET, PU, ABS, and PS). These approaches have been applied in mechanistic in-vitro studies and in human observational studies using two deeply phenotyped cohorts. Mechanistic studies show that MNPs can cross cellular layers representing the placental barrier. Perfused placenta experiments confirm transport but indicate that the amount transferred is potentially limited. Biological assessments of cells exposed to various MNPs reveal minimal acute toxicological effects, with some exceptions, such as polyamide-induced oxidative stress. While these findings suggest that acute biological effects may be modest, uncertainties remain regarding long-term impacts and real-world exposure scenarios. Analysis of placental tissue from 804 mother–child pairs in the ENVIRONAGE (n = 695) and BiSC (n = 109) cohorts demonstrated that MNPs were detectable in nearly all samples, most containing four to six polymer types. SBR, N66, PE, and N6 were the most frequently identified polymers. Detection patterns differed by cohort: PMMA was more prevalent in BiSC whereas all other polymer detection rates and concentrations were higher in ENVIRONAGE, reflecting distinct exposure profiles. Ongoing analyses are evaluating associations between prenatal MNP exposure and birth weight, immune and metabolic programming, and early-life developmental outcomes. Together, the preliminary results of AURORA show that human exposure to MNPs is widespread, that MNPs can cross the placental barrier in experimental systems, and that certain polymers may elicit biological effects at high concentrations. Although acute toxicological responses appear limited overall, the consistent presence of MNPs in placental tissue across populations suggests a potential risk to fetal development that warrants further investigation.

92. OH radical-driven aging of microplastics: A key atmospheric process that demands Attention - Taicheng An

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Microplastics are ubiquitous in the atmosphere and have been detected even in remote regions. Airborne long-distance transport is a major pathway for the global dispersion and human exposure of microplastic. During long-distance transport, microplastic can interact with pollutants, such as volatile organic compounds (VOCs), to form complex mixtures. Moreover, microplastic can undergo photodegradation in the presence of sunlight and react with atmospheric reactive oxygen species, leading to the breaking of polymer chains and the introducing of oxygenated functional groups. Both mixing and oxidative processes drive the aging of microplastics, and thus influencing the environmental impacts and toxicity of microplastics.

In this study, polyethylene (PE) was chosen as a representative microplastic, and dimethyl selenide was chosen as a representative VOC. Ab initio molecular dynamics (AIMD) simulations were performed to investigate the mixing mechanism of microplastics with VOCs and the aging mechanism of the mixture by OH radicals. The AIMD trajectories revealed that dimethyl selenide interacts with PE surface via weak interactions between H atom of PE and the Se atom of the dimethyl selenide. It remained bound to the surface of PE throughout the simulation, indicating that dimethyl selenide readily adsorbed onto the PE surface. Upon introducing an OH radical, H-abstraction reaction occurred at the methylene groups of PE and the methyl groups of the adsorbed dimethyl selenide, yielding radical sites. These results demonstrate that microplastic can form mixture with atmospheric VOCs, and both microplastic and VOCs can be rapidly oxidized by OH radical, leading to the aging of microplastic. Such oxidative aging may increase the toxicity and influence the radiative effects of microplastic, highlighting the importance of considering the aging caused by OH radicals in assessments of atmospheric microplastic fate and risk.

93. Are Plastic Regulations in India Protecting Human Health? A Comparative Policy Analysis of India with the European Union and the United States to Enable the Transition to a Safe Circular Economy for Plastics - Gayathri Govindarajan

Gayathri Govindarajan[1]

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Plastic regulations in India have primarily addressed plastic waste management, leakage, and pollution with a lack of focus on emerging evidence of human health risks arising from plastics and associated chemicals. It is essential that human health risks are addressed to ensure a transition to a safe circular economy. This study assesses the extent to which India's regulatory framework addresses these risks, in comparison to the European Union (EU) and the United States (US). Indian regulations reviewed include India's Plastic Waste Management Rules (2016, 2022), Bureau of Indian Standards (BIS) for standards on food-contact plastics, and guidelines issued by the Central Pollution Control Board (CPCB), and the State Pollution Control Board (SPCB). International regulations reviewed include the EU's REACH and US Food and Drug Administration (US FDA) Food Contact Materials Regulation. Through a structured coding framework, plastic regulations were analysed for references to human health, consideration of key chemicals of concern to human health (including BPA, phthalates, PFAS), and provisions for risk assessment and monitoring. This study indicates that while India has strengthened its plastic regulations, explicit links to human health remain limited in Indian plastic regulations. When compared to the EU and US, in India there is a lack of strong mechanisms for specific restrictions in chemicals and monitoring for human health impacts in India. Critical gaps in India's regulatory approach to plastics to adequately protect human health are elucidated, including the lack of monitoring plastics-associated chemicals, and the limited integration of emerging evidence into regulations. This study recommends steps to improve and align plastic regulations in India with international best practices, which include a greater emphasis on chemical inventories, biomonitoring, and health risk assessments. This comparative policy analysis provides insights to strengthen Indian plastic regulations that enable the transition to a safe circular economy.

94. Our Dirty Laundry: The Public's Role and Policy Pathways to Reduce Synthetic Microfibre Emissions From Households — Insights From Two Coastal Cities and a National Canadian Survey - Soma Barsen

Soma Barsen[1], Nancy Olewiler[2]

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Synthetic microfibres (MFs), shed during the wear and washing of petrochemical-based textiles, represent a major source of land-based microplastic (MP) emissions. Detected across all environmental media, they are potential risks to human and ecological health. Although mitigation measures exist (e.g., washing machine filters and improved textile design) meaningful progress remains limited. A key barrier is the lack of understanding of the public's role as both contributors to and agents of change in addressing MF and MP pollution. This study addresses that barrier through a rigorous, original questionnaire survey administered to representative samples in Metro Vancouver, British Columbia (N = 1034; ME = ±3.54%) and Los Angeles, California (N = 502; ME = ±4.37%), and extended nationally in a Canada-wide survey spanning ten provinces (N = 2499; ME = ±1.96%). We examined the public's objective knowledge, laundry and purchasing behaviours, attitudes toward MF and MP pollution, preferences for interventions, and support for mitigation measures. Taking a solutions-focused approach, the study is the first to assess the sociological drivers of household MF emissions and evaluate the practicability, feasibility, and cost-effectiveness of household-level interventions and mitigation policies. The results provide statistically representative portraits of the surveyed populations and offer critical insights into public perceptions of MP pollution and anticipated responses to future regulatory initiatives. Household-level determinants (family composition, finances, and domestic priorities) are often fixed. Consumer-level behavioural interventions alone are unlikely to reduce emissions. Across all populations, respondents favoured low-cost clothing (that emit most MF), and few people prioritised sustainability. Support for strict regulation of the fashion and appliance sectors was high across all regions, but knowledge tests revealed persistent knowledge gaps across all populations. MF and MP pollution are not politically or socially divisive issues. Public concern and support for regulatory intervention are shared across socioeconomic and ideological lines. Importantly, knowledge was the strongest predictor of concern about MF and MP pollution—and an indirect driver of support for policy action.

95. Sustainable production and consumption of single-use plastic packaging: expert interpretations and major supermarket representations in Aotearoa New Zealand
- Maria Ross

Maria Ross[1], Glenn Banks[1], Trisia Farrelly[2], Samantha Gardyne[1]

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Supermarkets trade a plethora of products wrapped in single-use plastic packaging. Plastic packaging is a source of human exposure to micro and nano plastics and plastics chemicals, and accounts for 36% of global plastics production. Independent scientists recommend a set of harmonised criteria to assess the sustainable production and consumption of plastics including single-use plastic packaging is critical for policy development that effectively protects human and environmental health. However, the spaces where public and private actors make decisions and produce knowledge allow for broad interpretations of sustainable production and consumption and the criteria by which it may be assessed. These interpretations may influence the effectiveness of plastic pollution policies. This study offers insights into how local experts interpret the criteria to assess sustainable production and consumption of single-use plastic packaging (essential use, safety, sustainability, and transparency), and how the two major supermarkets in Aotearoa New Zealand represent these terms. The study involved critical discourse analyses of transcripts from 22 expert interviews, 13 major supermarket sustainability documents and one written response from a major supermarket. The methodology is based on Foucault's 'discourse' which highlights power, language, and knowledge relationships. Although meanings varied between experts, current single-use plastic packaging production and consumption is generally understood as 'unsustainable', and 'transparent trade' is considered hindered by a lack of access to data. Meanings associated with 'safety' and 'essentiality' are more diverse as they both reflected dominant discourses that perpetuate the status quo as well as revolutionary ideas that challenge business as usual. Experts agree that something needs to change but collectively they are not clear what or how. Major supermarkets generally describe 'sustainable packaging' as packaging that is 'recyclable', 'compostable', 'reusable', or containing 'recycled content'. 'Transparency' was related to labelling and reporting, but major supermarkets were unclear about what constituted 'safe' and 'essential use' of single-use plastic packaging. The study highlights that actors involved in Aotearoa New Zealand's shift to the sustainable production and consumption of single-use plastic packaging have diverse understandings of what sustainable production and consumption is and how to achieve it.

96. Dynamic inventory of microplastic fibre emission from synthetic textiles: An Australian case
- Mithun Kumar Biswas

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Microplastic fibre (MPF) pollution from synthetic textiles is an emerging global environmental and public health concern, yet policy responses remain fragmented due to significant knowledge gaps in emission sources, magnitudes, and exposure pathways. Synthetic textiles are one of the few plastic-based products in continuous and intimate contact with people, creating repeated opportunities for direct exposure through wearing, washing, and drying. As global consumption continues to rise, the scale and severity of MPF pollution are expected to intensify. To address this, our study develops a comprehensive, dynamic inventory of MPF emissions across the entire life cycle of synthetic textiles, integrating product-level activity data with pathway-specific emission factors. Using Australia as a case study, the model estimates that 30.9 ± 0.56 kt of MPFs were released between 1988 and 2023, with nearly half emitted into the air from everyday household activities. Key household products, such as bed linens, carpets, suits, and cleaning cloths, were responsible for the majority of airborne and waterborne emissions in 2023, revealing clear hotspots for targeted intervention. Cumulative waterborne releases (5.68 ± 0.56 kt) during this timeline (1988-2023) contribute to indirect ingestion through contaminated drinking water and seafood, while terrestrial releases (10.89 ± 0.54 kt), largely driven by land applications of wastewater sludge, create long-term risks as fibres accumulate in agricultural soils and enter food crops. Without action, emissions are projected to rise by 43% by 2050, with cumulative per capita MPF loads reaching 84 ± 0.89 kt, deepening environmental background concentrations and increasing chronic exposure across multiple compartments. Fragmented or poorly coordinated interventions can also shift the burden from one environmental compartment to another, such as from water to soil through inadequate sludge management. However, an integrated mitigation strategy involving all stakeholders, combining behavioural, technological, and infrastructural measures, could reduce emissions by up to 65%. This study underscores the urgent need for a proactive, evidence-based policy for synthetic textiles in Australia. By generating quantitative, system-wide source inventories, it provides the foundation needed to link textile-related emissions with fate, exposure, and health-risk assessments, enabling more targeted and effective regulatory action.

97. Targeting toxic textiles: policy guidance for a safer circular economy for polymer-based textiles in New South Wales

- Rachael Wakefield-Rann

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This poster presents findings from an interdisciplinary project analysing samples from plastic-based textiles to understand emerging hazards to human health and the environment. With funding from the New South Wales Environmental Protection Authority, we are utilising state-of-the-art testing facilities to provide data on legacy and emerging chemical classes in new, post-consumer and recycled textile products. This data will improve knowledge of where toxicants enter the plastics economy, and help guide regulatory and policy responses. It is the first study to compare contaminant levels in new (off-the-shelf), recycled and post-consumer garments in Australia. Of the 3,500 substances used in textile production, 750 have been classified as hazardous for human health, and 440 for the environment, with around 20% of global water pollution estimated to be caused by textile dyeing and finishing processes. While some of these substances have been regulated or phased out, they are still in older textiles that may be collected for recycling. These chemicals, in addition to those added during the use-phase of a product, or inadvertently introduced during recycling processes, will often be transferred to recycled products. Moreover, the addition of new recycled materials into textiles, such as recycled PET bottles or marine plastic pollution, increases the range of potentially hazardous substances that are being transferred into recycled textiles. Despite these risks, there is still limited research on the chemical content of textiles, and recycled textiles in particular. This situation presents a significant policy challenge, as textile recycling is increasingly promoted across government, and by product stewardship schemes, as the primary strategy for a circular textile industry. This poster will present the policy-relevant findings to date from this project, including: 1. The first indicative baseline of data about hazardous chemical contamination in polymer-based textiles sold in Australia. 2. Analysis of their probable sources (e.g. applied during manufacturing, recycling or use) and their policy implications, and 3. Policy and regulatory guidance to prevent the further circulation of hazardous substances, such as product design criteria, targeted substance restrictions, tracing mechanisms, and safer circular economy strategies.

98. Beyond Awareness: Psychological and Institutional Barriers to Effective Policy Action on Plastic

- Richard Reeve

Richard Reeve

Despite extensive public awareness of plastic pollution's harms, policy responses continue to lag behind scientific consensus. This paper investigates the psychological, political, and institutional factors that impede effective regulatory action on plastics, drawing on Australian case studies of environmental policy reform. Using a behavioural-economics lens, the research explores how cognitive biases, framing effects, and status-quo preferences shape both policymaker and public resistance to measures such as product levies, extended producer responsibility, and bans on single-use plastics.

The analysis integrates theories of collective-action failure, rent-seeking, and moral licensing to explain why economically efficient market-based instruments—long recognised as best practice—struggle for adoption. Media framing and partisan cues are shown to reinforce motivated reasoning, allowing vested interests to maintain narratives of cost, freedom, and consumer choice that obscure systemic externalities.

By combining policy analysis with insights from psychology and communication studies, the paper identifies opportunities for reframing plastic regulation around fairness, shared responsibility, and long-term wellbeing. It concludes with recommendations for institutional and rhetorical strategies that can help governments align behavioural realities with sustainability imperatives—offering lessons for addressing similar barriers in climate and pollution policy more broadly.