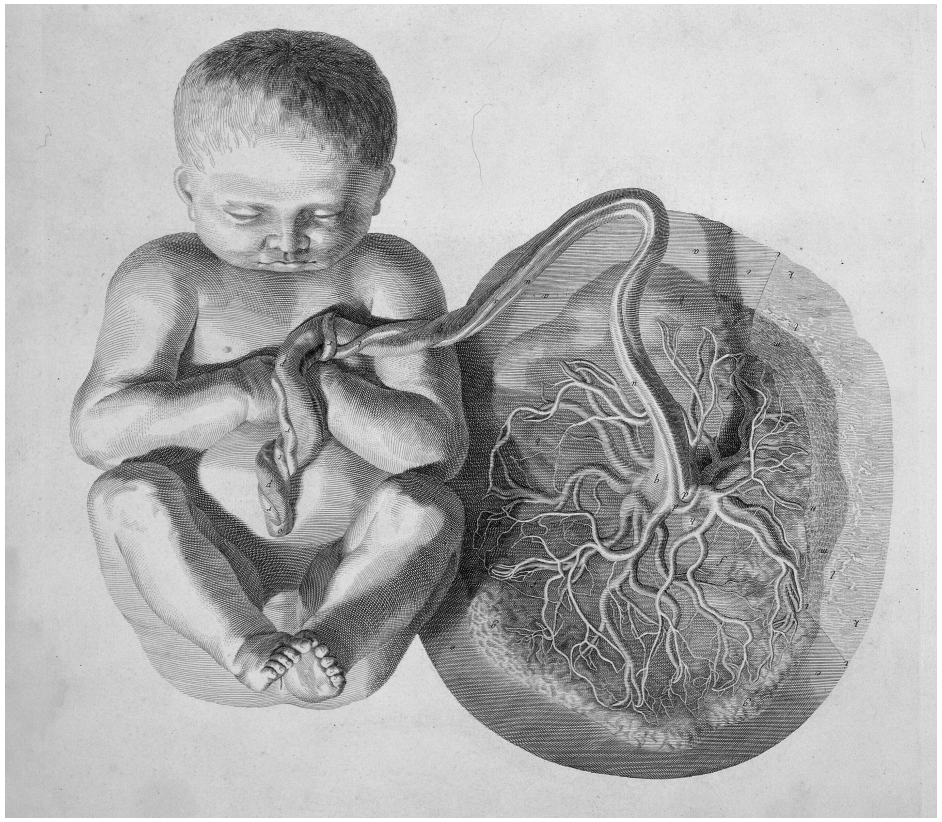
Uptake, transport and toxicity of micro- and nanoplastics in human placenta cells

Hanna Dusza

IRAS, Utrecht University

Meet the placenta



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https://motherhoodinprehistory.wordpress.com/2015/06/30;
https://wellcomecollection.org/works/pnbunkzq;

Air pollution (PM) and pregnancy

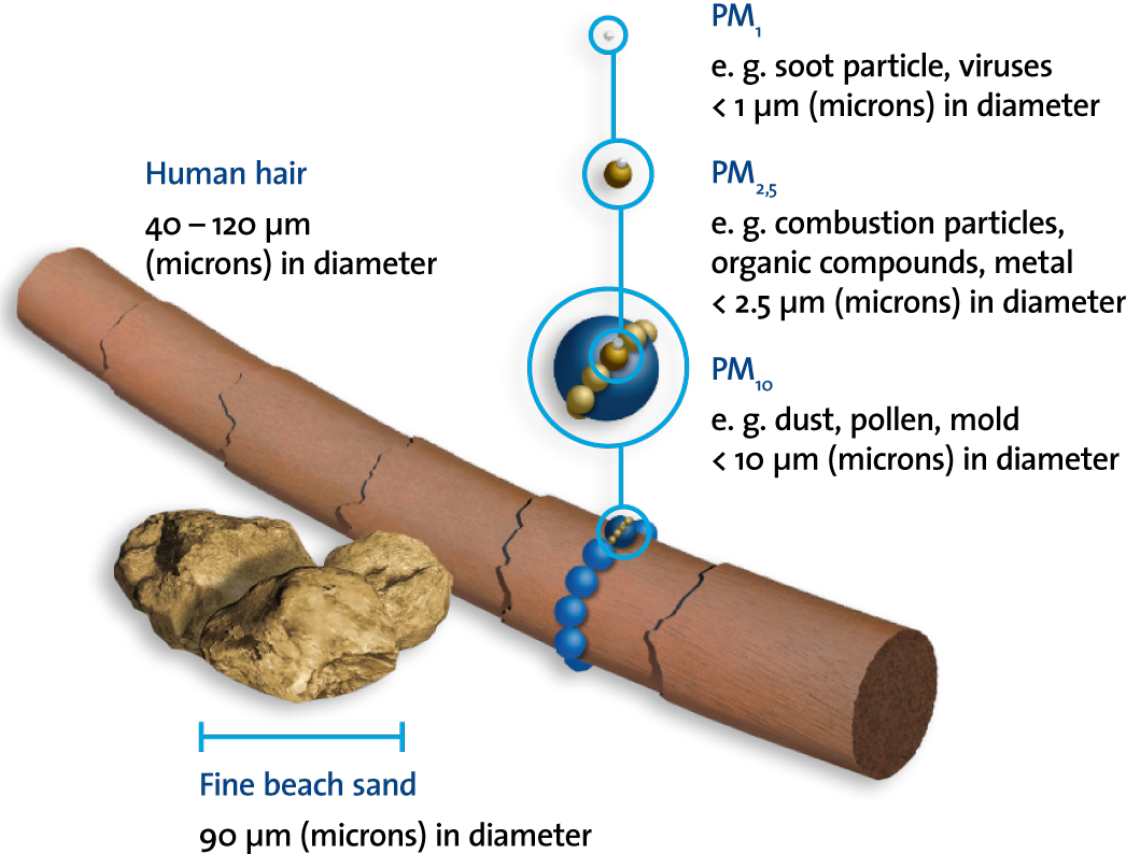

Image source: www.pikpng.com/transpng/hJmToi/

ARTICLE
https://doi.org/10.1038/s41467-019-11654-3 OPEN

Ambient black carbon particles reach the fetal side of human placenta

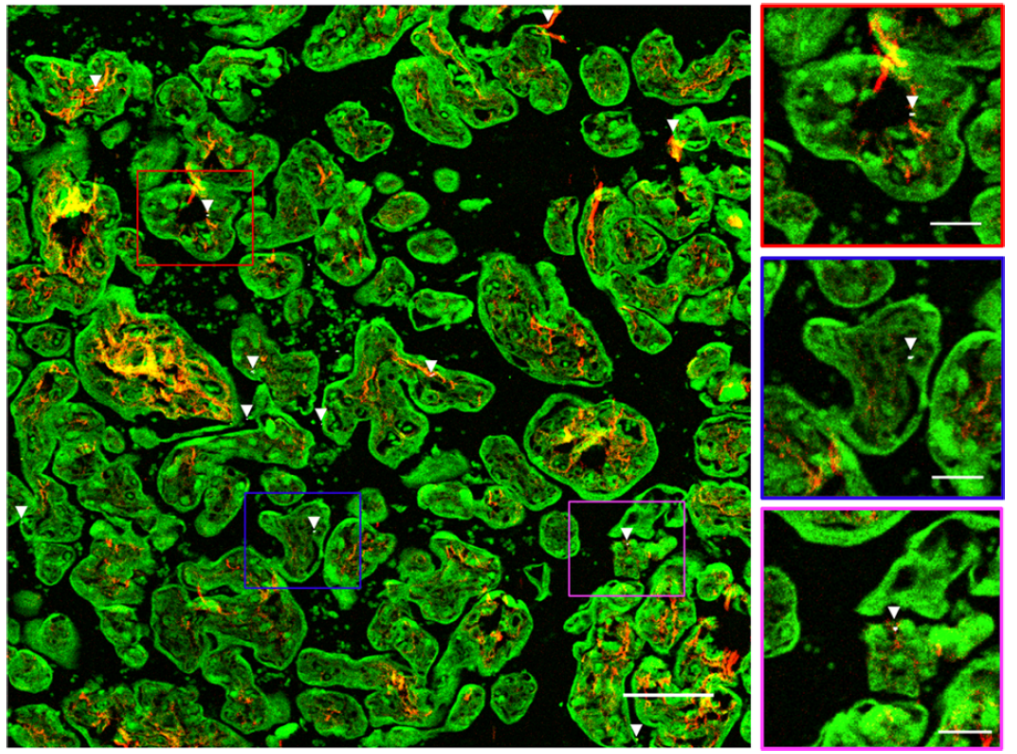

Fig. 2 Evidence of BC particles at the fetal side of the human placenta.

Bove et al, 2019, Nature Comm.

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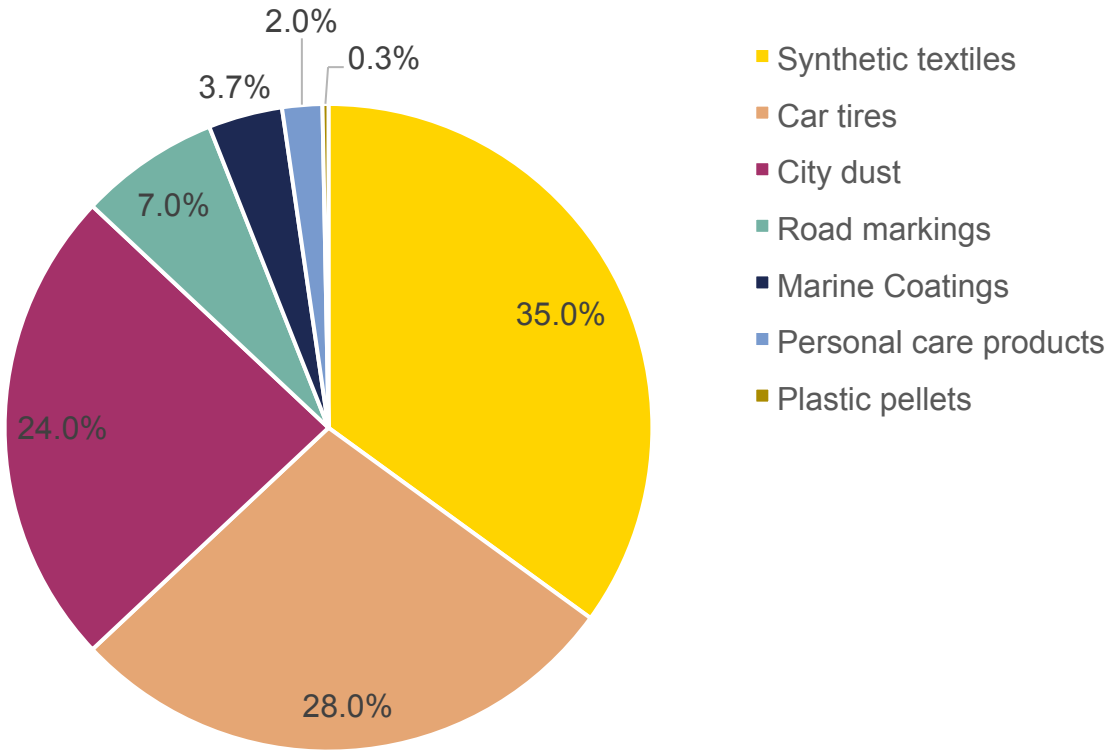
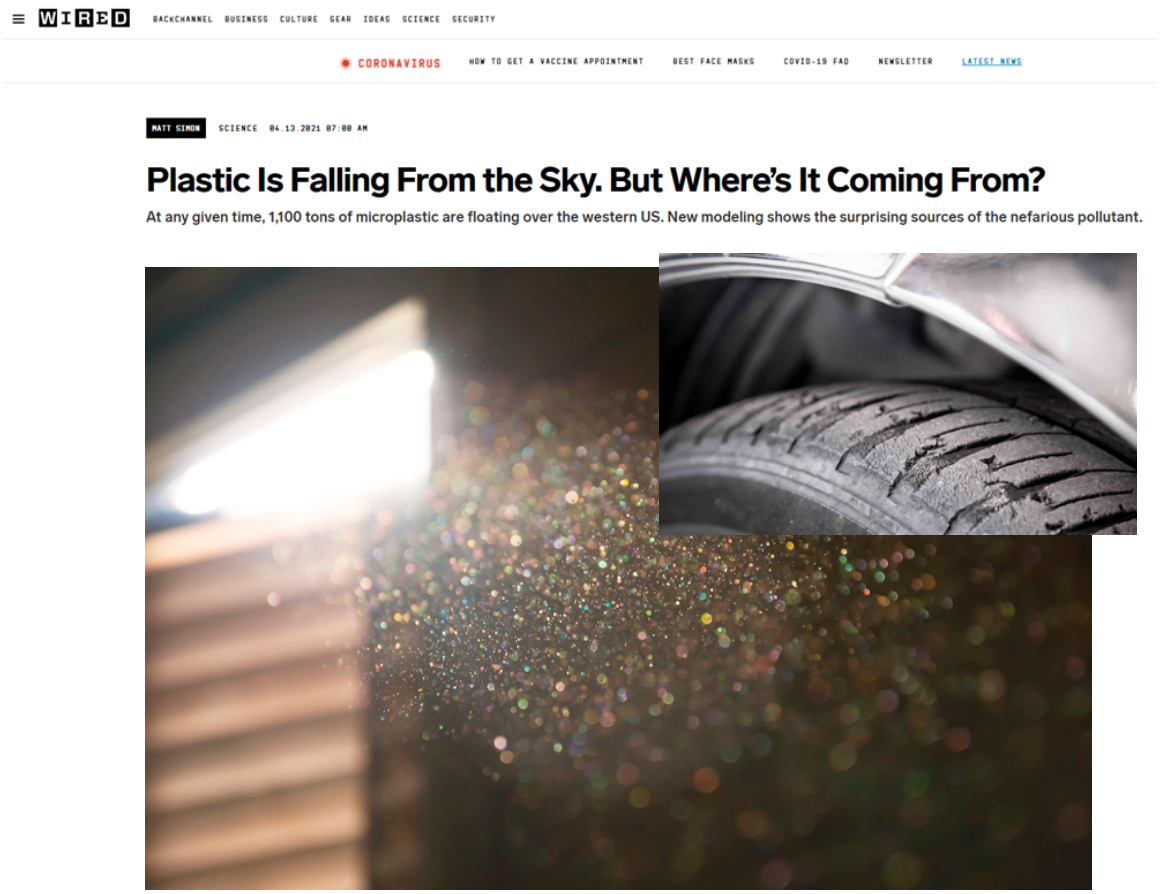
Air pollution and microplastics



Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN.



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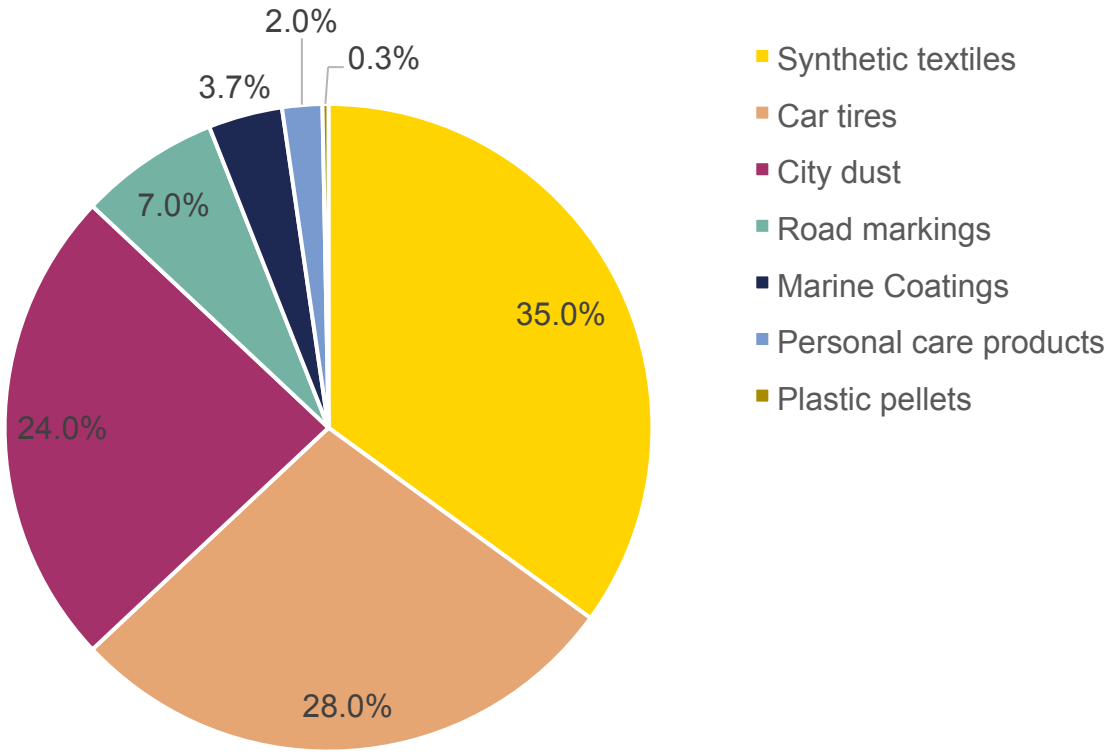
Air pollution and microplastics



Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN.

ELSEVIER

Journal of Hazardous Materials
Volume 418, 15 September 2021, 126245

Review

Microplastics as an emerging source of particulate air pollution: A critical review

Srinidhi Sridharan [a, b], Manish Kumar [b], Lal Singh [a, b], Nanthi S. Bolan [c, d], Mahua Saha [a, e]

ELSEVIER

Environmental Research
Volume 192, January 2021, 110339

Suspended fine particulate matter ($PM_{2.5}$), microplastics (MPs), and polycyclic aromatic hydrocarbons (PAHs) in air: Their possible relationships and health implications

Razegheh Akhbarizadeh [a, b], Sina Dobaradaran [a, c, d], Mehdi Amouei Torkmahalleh [e], Reza Saeedi [f, g], Roza Aibaghi [c], Fatemeh Faraji Ghasemi [a]

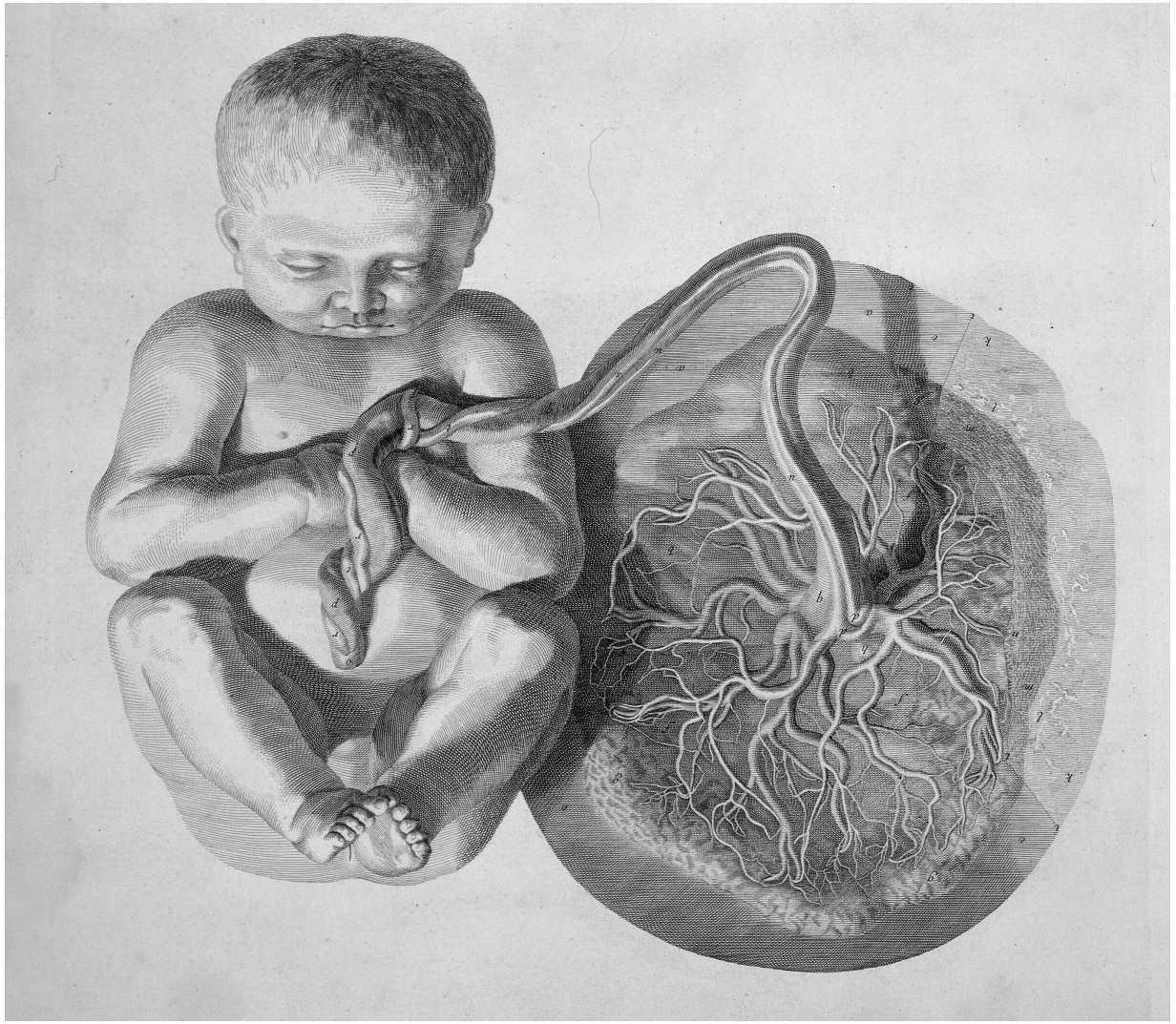
Utrecht University

Research aims

Can microplastic be taken up/ transported through the placenta?

Can microplastics cause harm to the placenta?

Can the chemicals associated with microplastics cause harm?



Albinus, Uterus II, Tab. V, illustration from 'Tabulae ossium humanorum', by Bernhard Siegfried Albinus (1697-1770)

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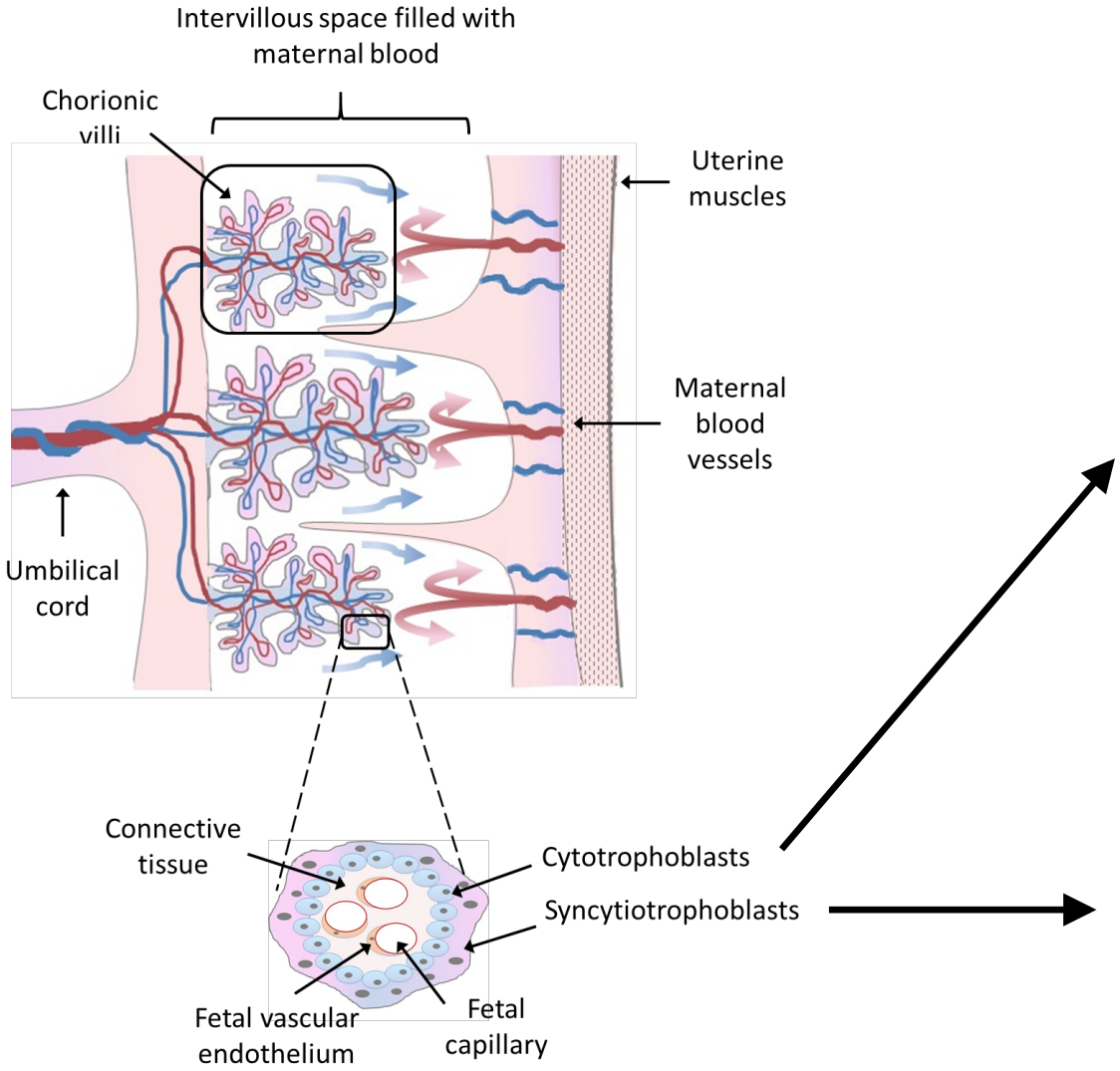
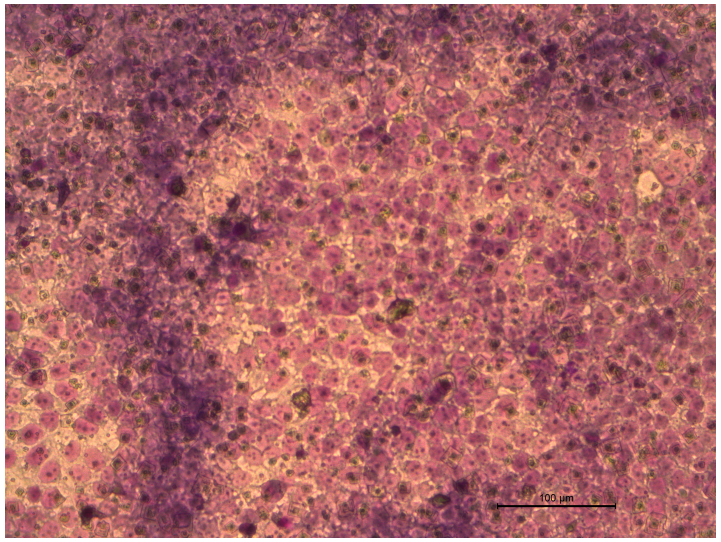
Placenta cells in vitro

A cross-section through placenta

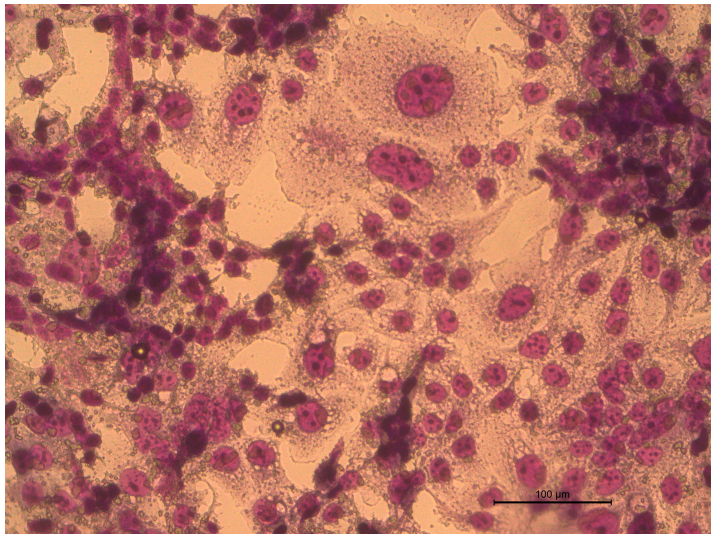


BeWo b30 cells

Non-syncytialized



Syncytialized



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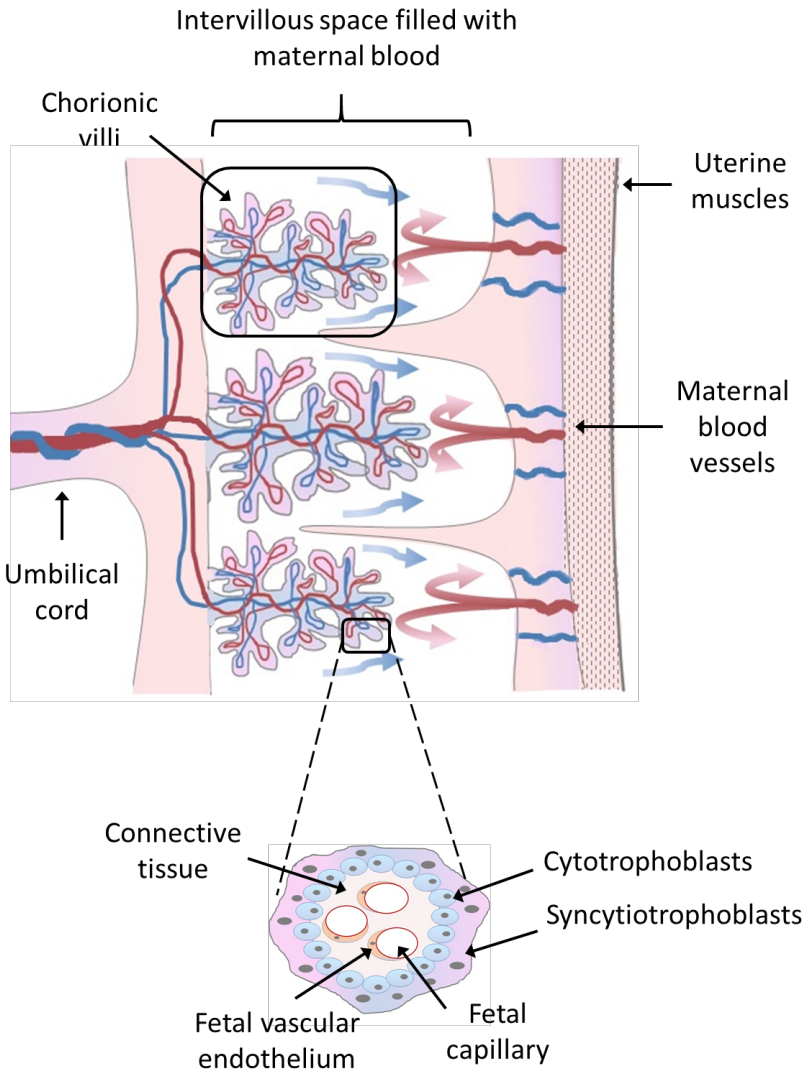
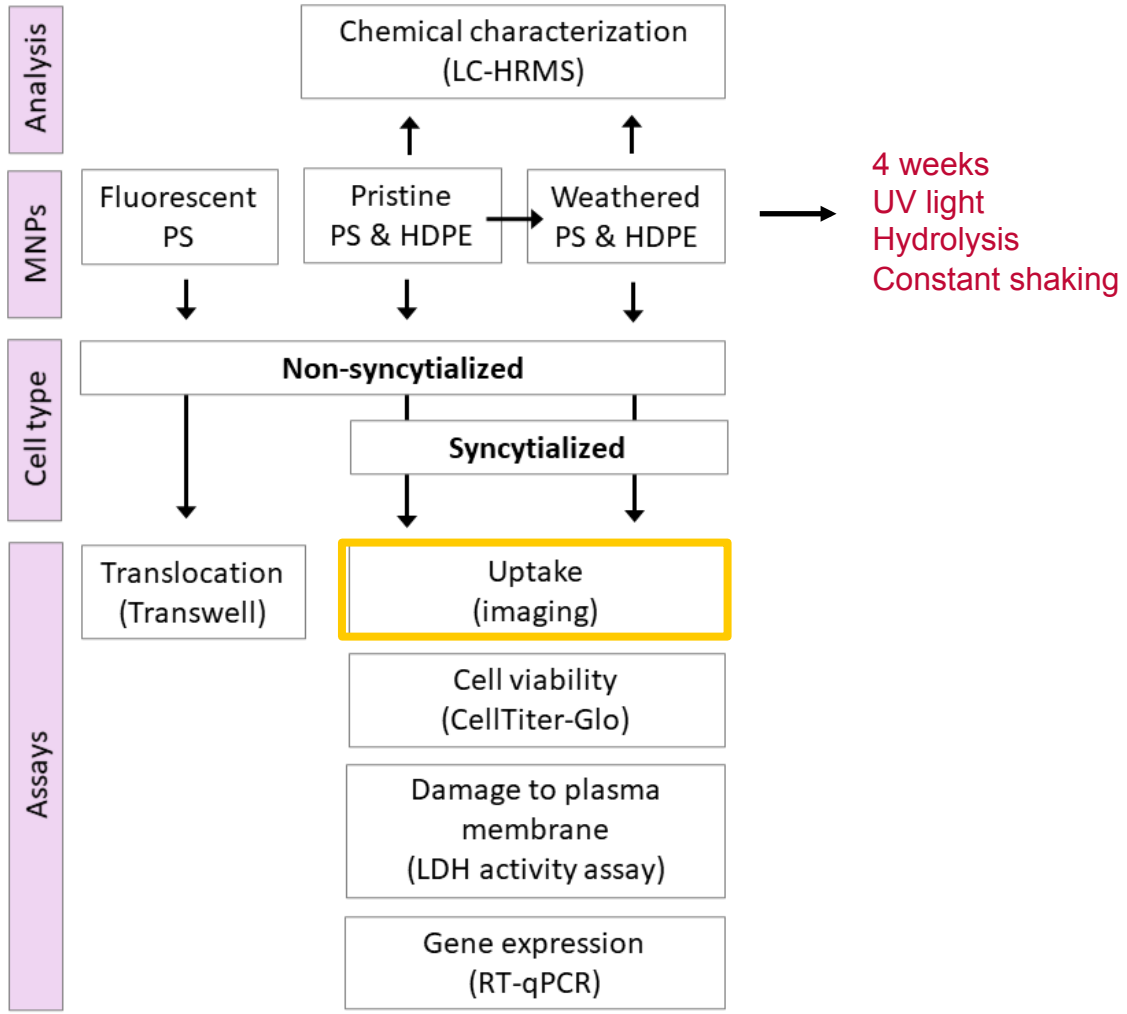
Dusza et al. 2021 Manuscript in prep

Placenta cells in vitro





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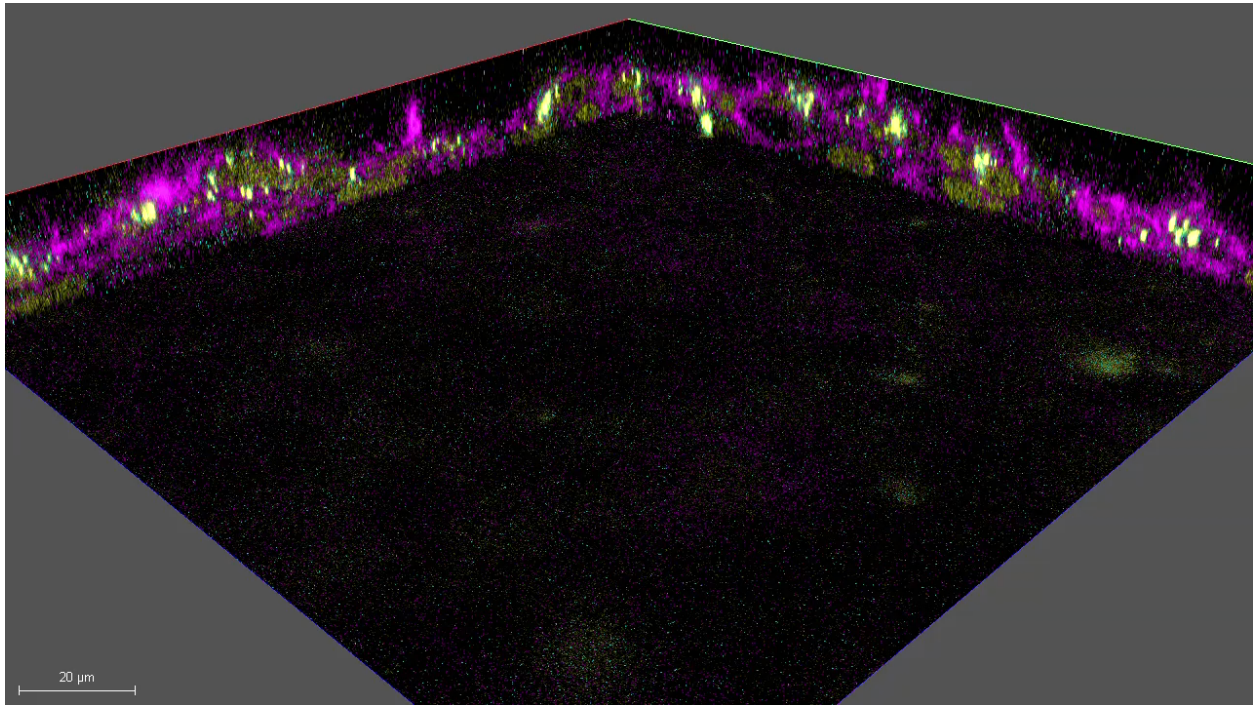
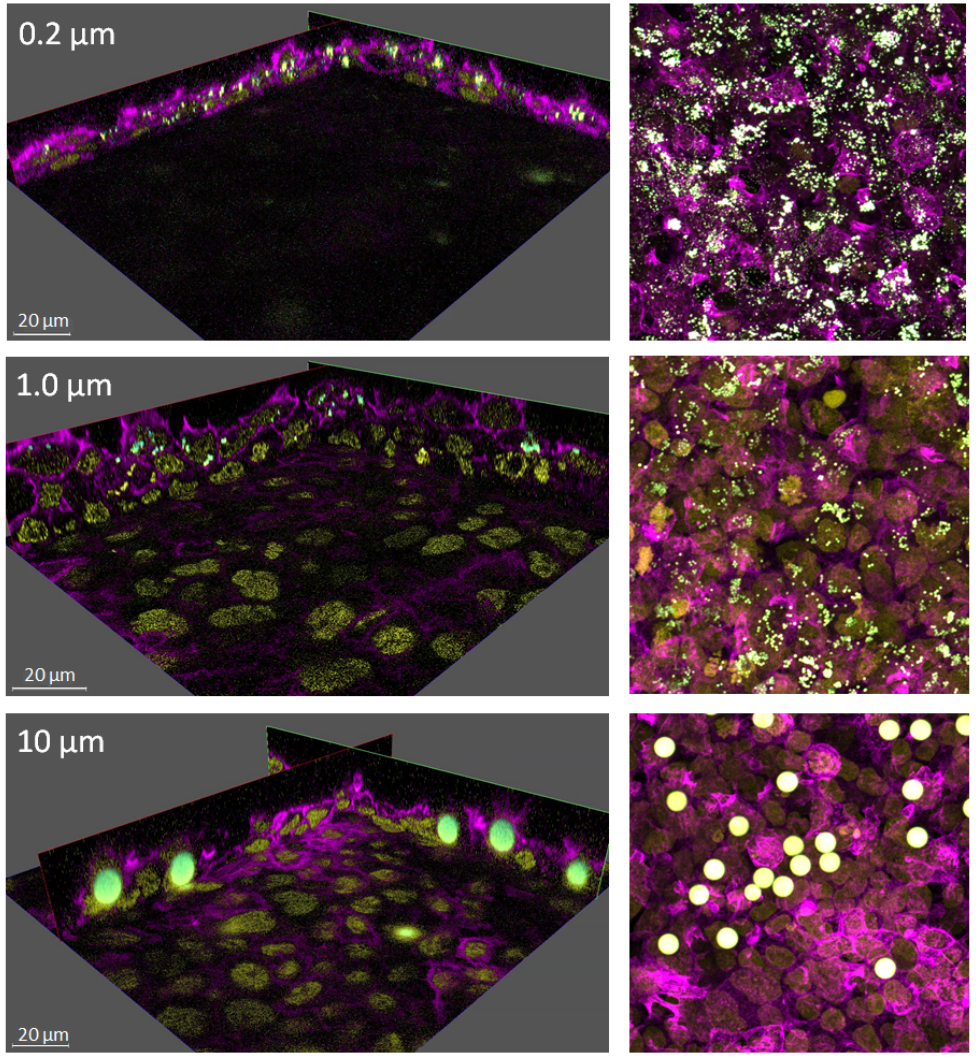
Uptake of microplastics in placenta cells



BeWo b30 cells (Leica TCS SP8 confocal microscope)



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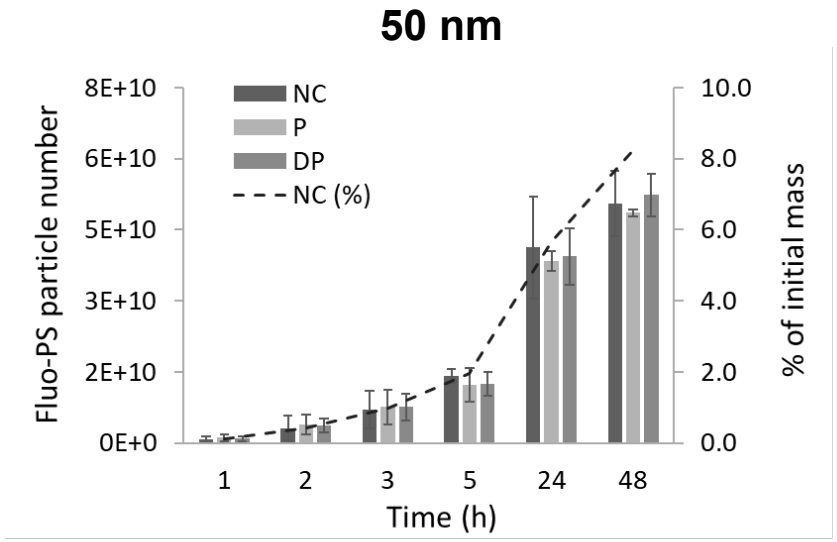
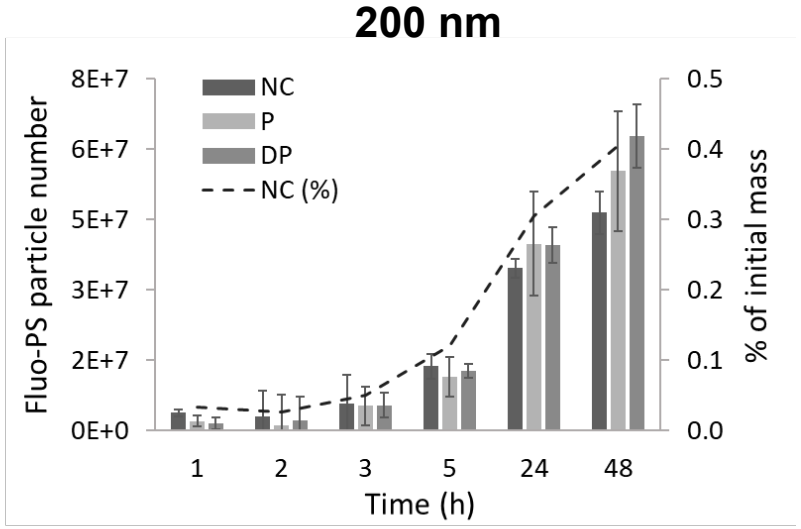
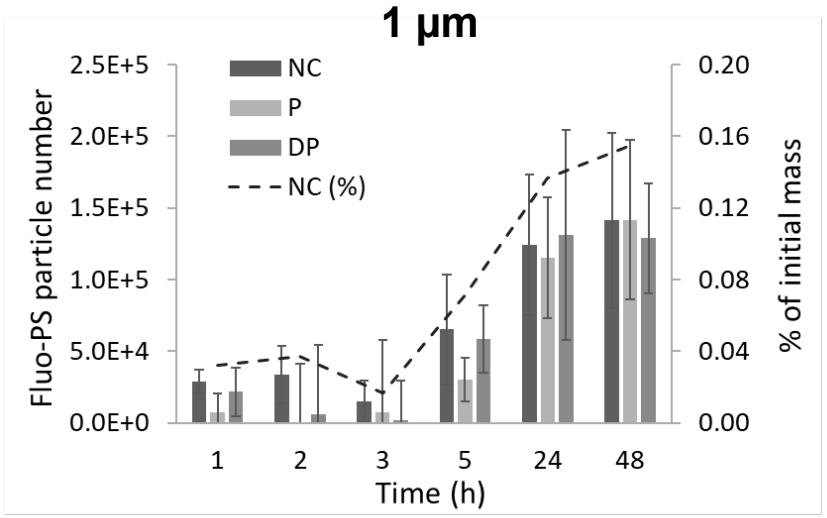
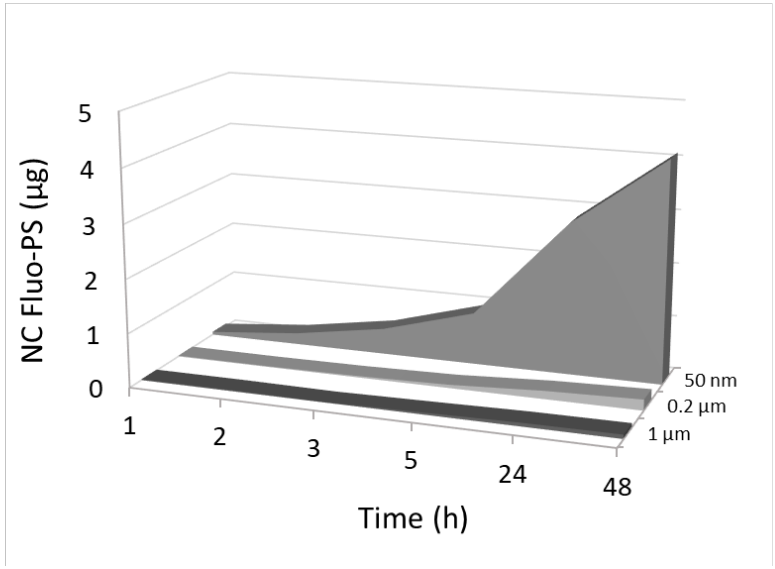
Transport of micro- and nanoplastics through placenta cells









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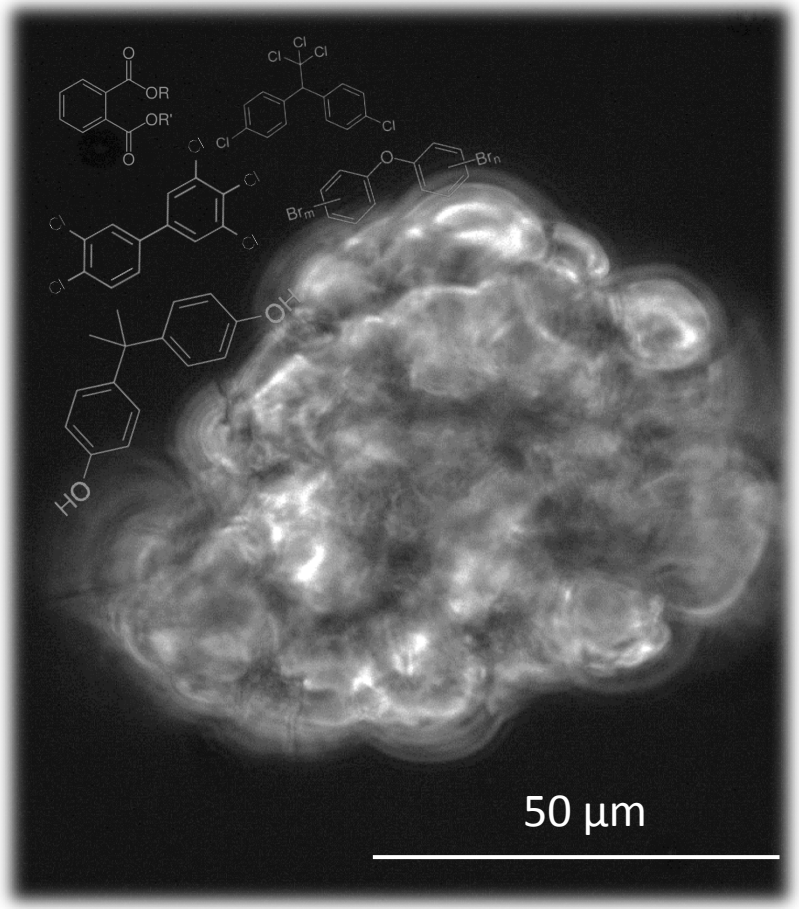
Particle or chemical toxicity?



PE microplastic (Leica TCS SP8 confocal microscope)

Deep Dive into Plastic Monomers, Additives, and Processing Aids

Helene Wiesinger,* Zhanyun Wang,* and Stefanie Hellweg

		CASRNs	Substance type: Metal	Substance type: Organophosphor	Substance type: Organohalogen	Substance type: UVCB	Polymer type: One	Polymer type: Several	Industrial sector: One	Industrial sector: Several	Industrial sector: Packaging	Industrial sector: B&C	Industrial sector: Automotive	Industrial sector: EEE	Industrial sector: Agriculutre	Industrial sector: Household	Industrial sector: Medical items	Industrial sector: Textiles	Production volume: Confidential	Production volume: <10	Production volume: 10-100	Production volume: 100-1 000	Production volume: >1 000	Hazard classification: PBT	Hazard classification: CMR	Hazard classification: EDC	Hazard classification: AqTox	Hazard classification: STOT_RE
Data availability [% of the substances]			98%				28%		42%										42%					61%				
Functions																												
Monomers	Monomers	948																										
	Intermediates	1 740																										
Additives	Antioxidant	581																										
	Biocide	1 242																										
	Colorant	3 663																										
	Filler	1 833																										
	Flame retardant	364																										
	Impact modifier	31																										
	Light stabilizer	762																										
	Nucleating agent	25																										
	Odor agent	843																										
	Plasticizer	864																										
Processing aids	Antistatic agent	200																										
	Blowing agent	102																										
	Catalyst	708																										
	Crosslinking agent	895																										
	Heat stabilizer	213																										
	Initiator	478																										
	Lubricant	1 679																										
	Solvent	73																										
	Viscosity modifier	128																										
	Others	2 974																										
Uncategorizable		3 282																										
Total CASRNs		**10 547**	2 332	272	1 464	2 703	1 317	1 671	1 488	2 538	2 489	2 069	2 203	1 940	721	1 340	247	2 429	1 246	86	921	1 123	3 975	57	951	30	1 646	891

CASRNs per group: 10, 50, 100, 250, 500, 1000, 2000

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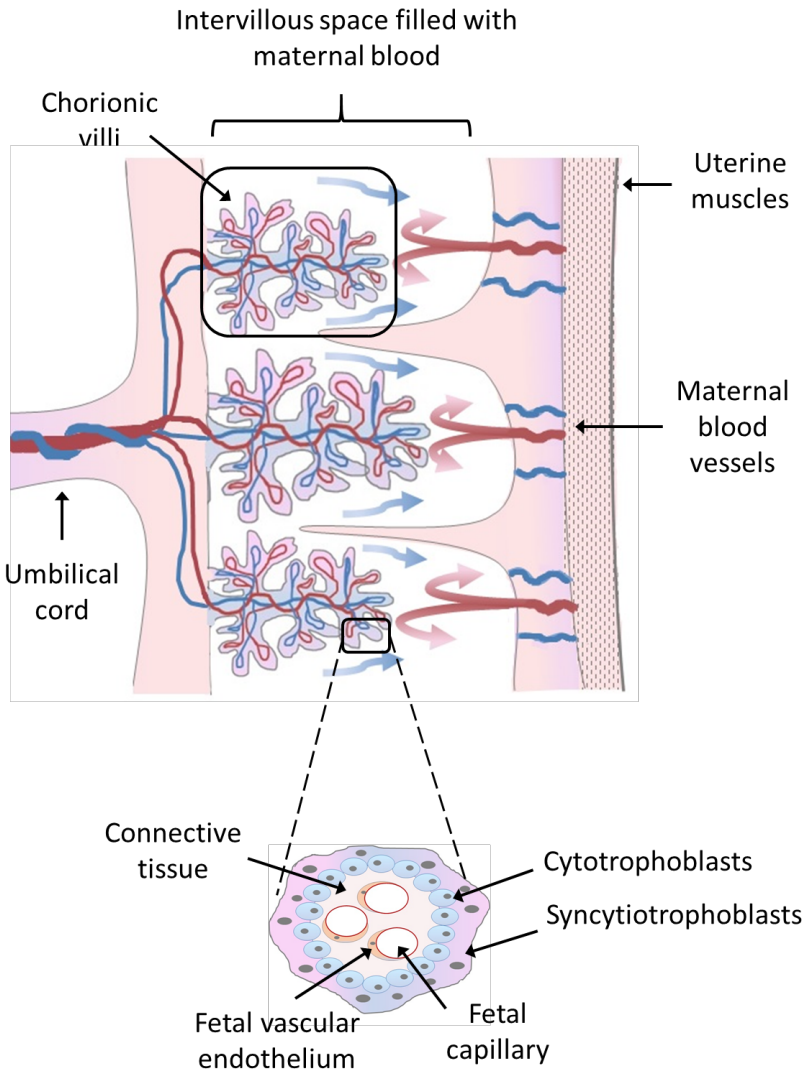
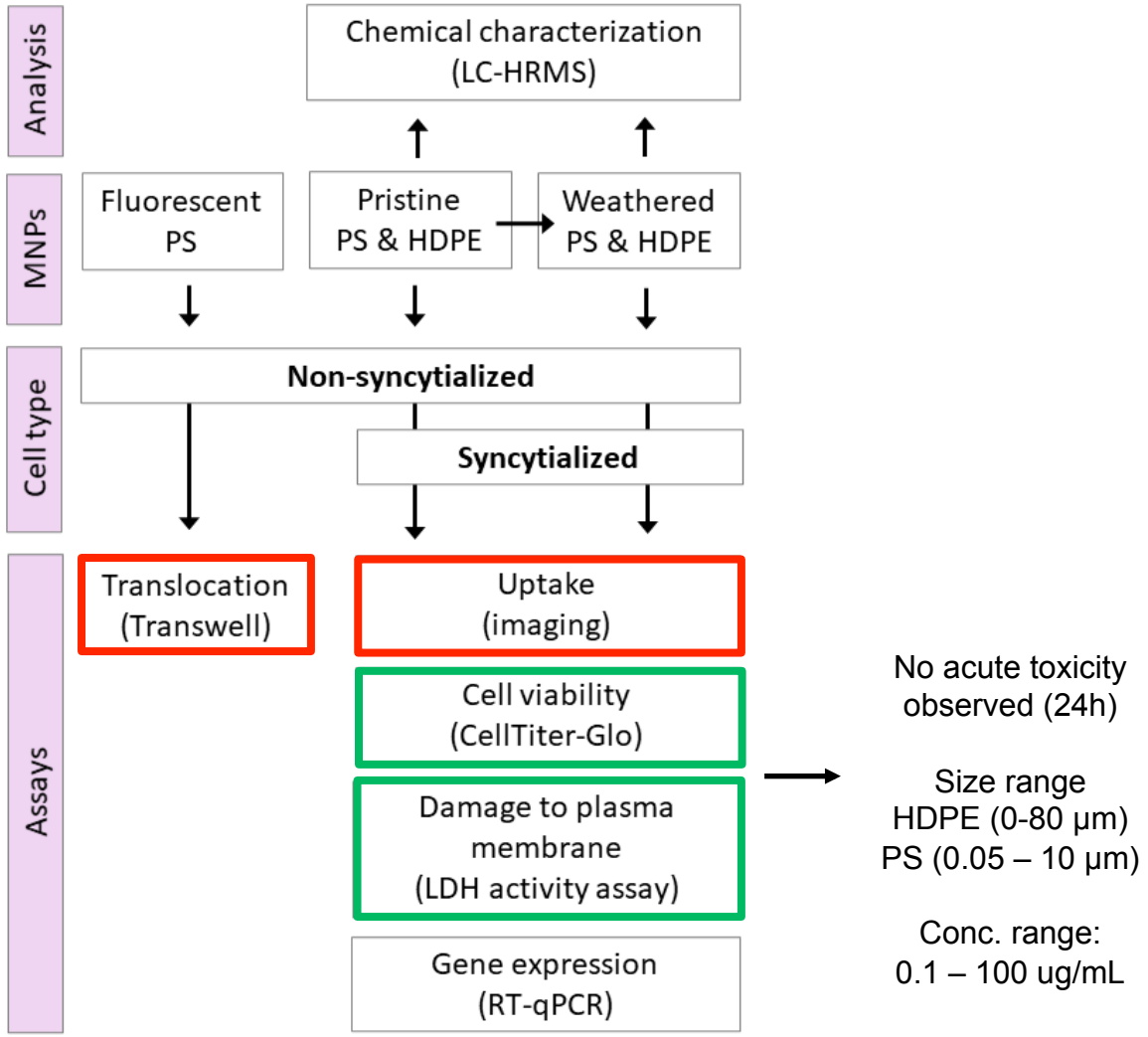
Placenta in vitro





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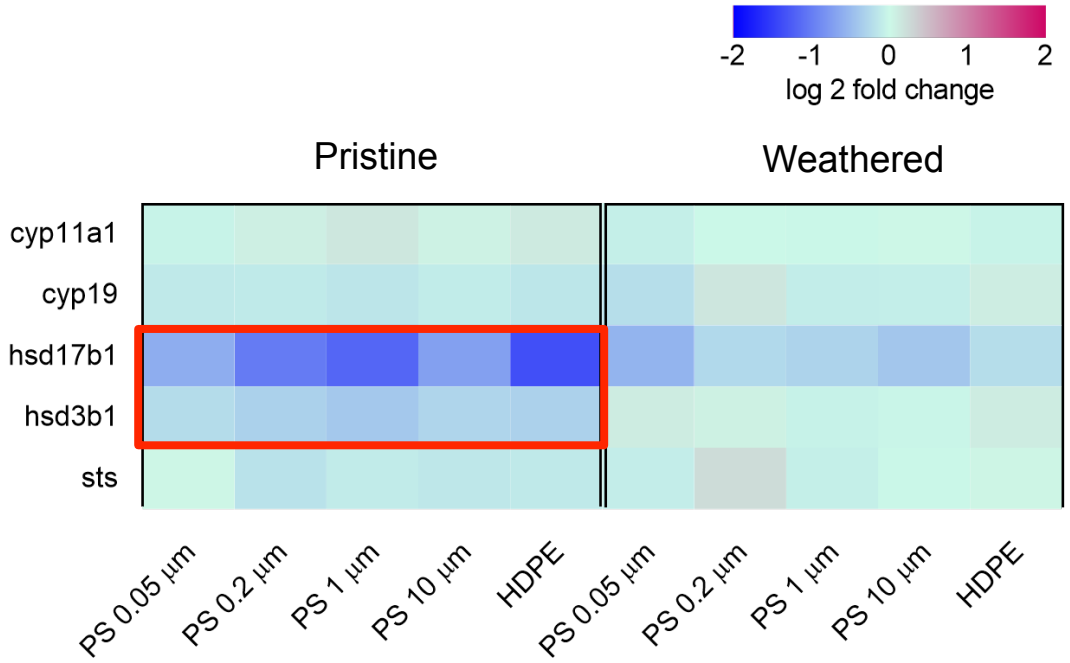
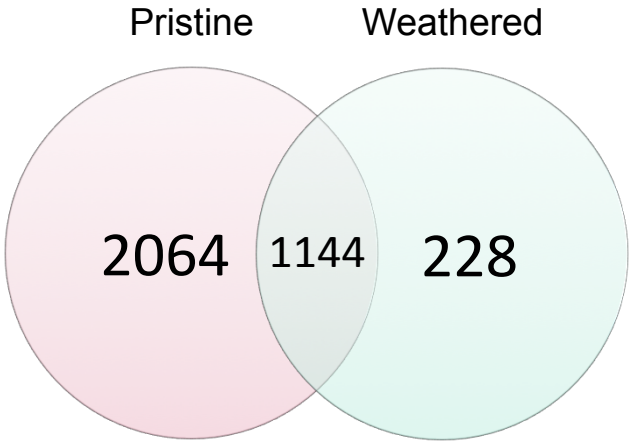
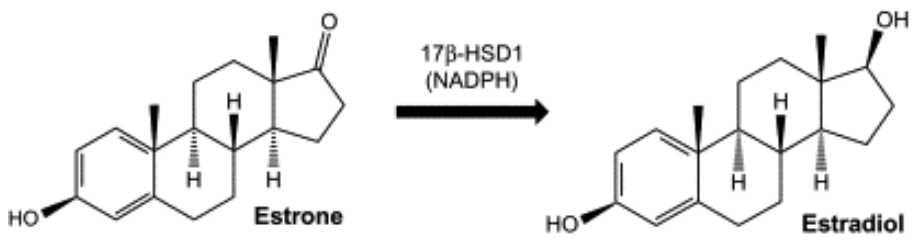
Particle or chemical toxicity?

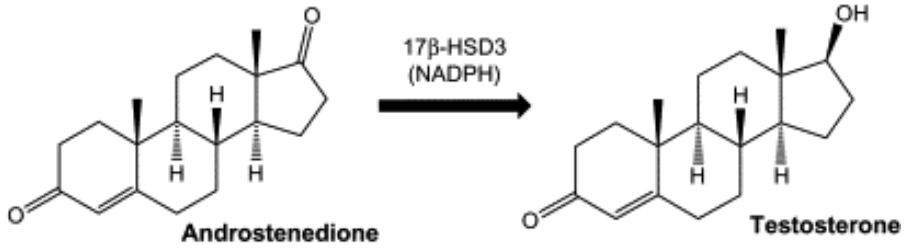
Gene expression
qPCR analysis



Chemical features
HR-LCMS







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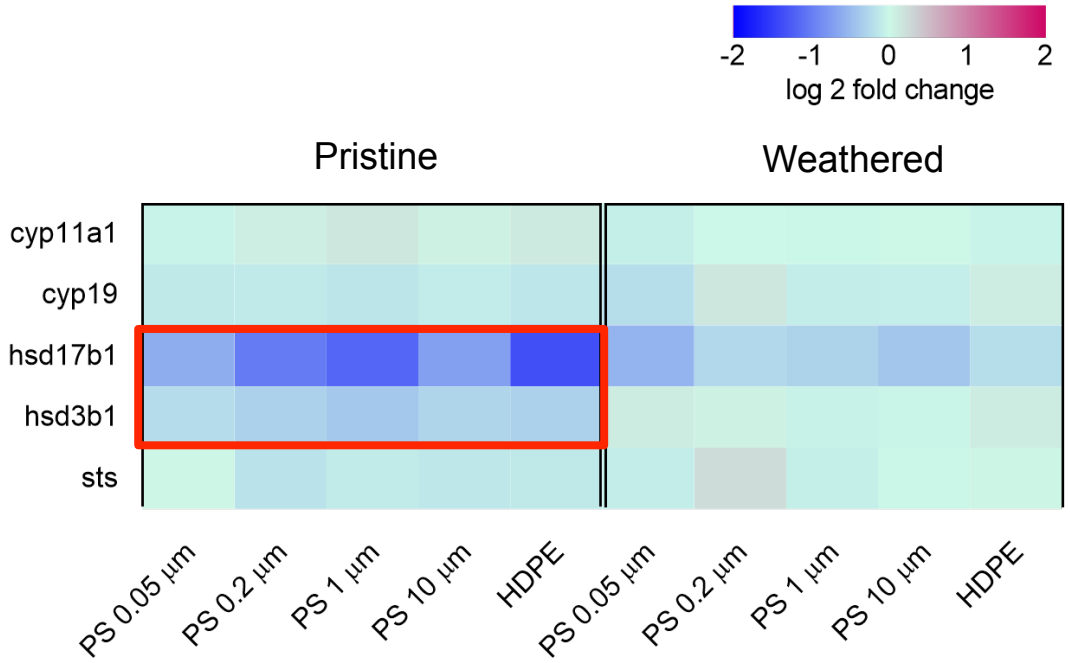

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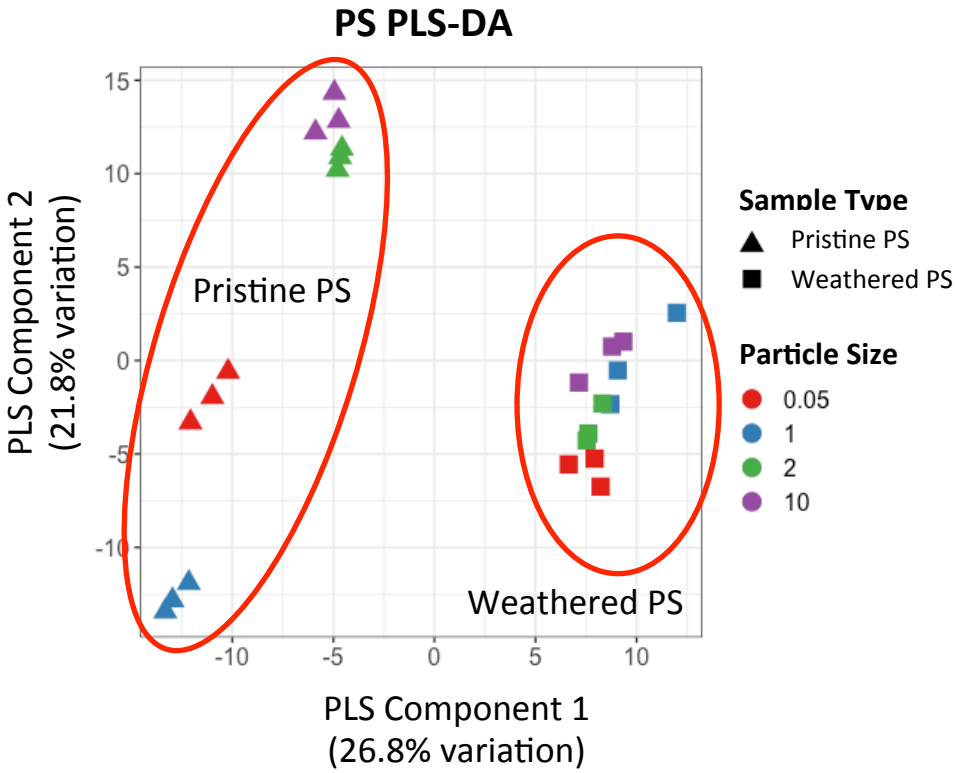

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First evidence of MNPs in foetal environment

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Plasticenta: First evidence of microplastics in human placenta

Antonio Ragusa [a], Alessandro Svelato [a,*], Criselda Santacroce [b], Piera Catalano [b], Valentina Notarstefano [c], Oliana Carnevali [c], Fabrizio Papa [b], Mauro Ciro Antonio Rongioletti [b], Federico Baiocco [a], Simonetta Draghi [a], Elisabetta D'Amore [a], Denise Rinaldo [d], Maria Matta [e], Elisabetta Giorgini [c]

pubs.acs.org/journal/estlcu

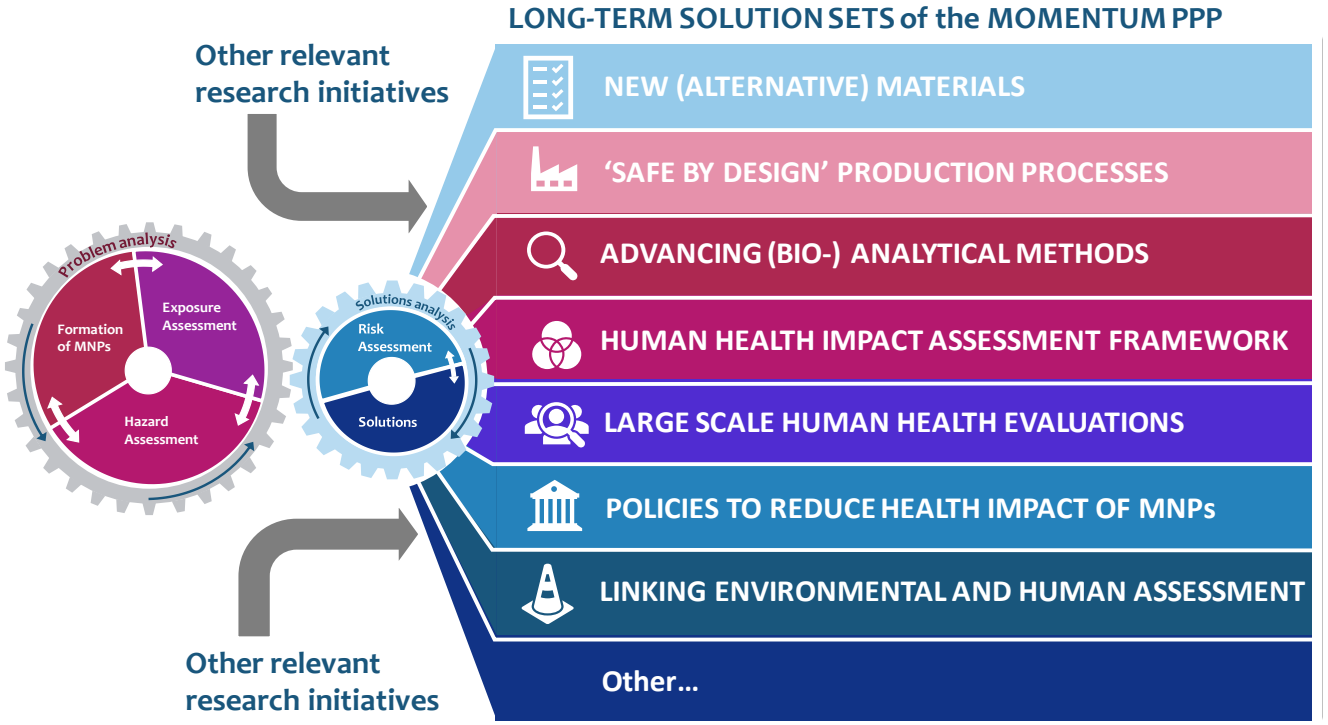
Letter

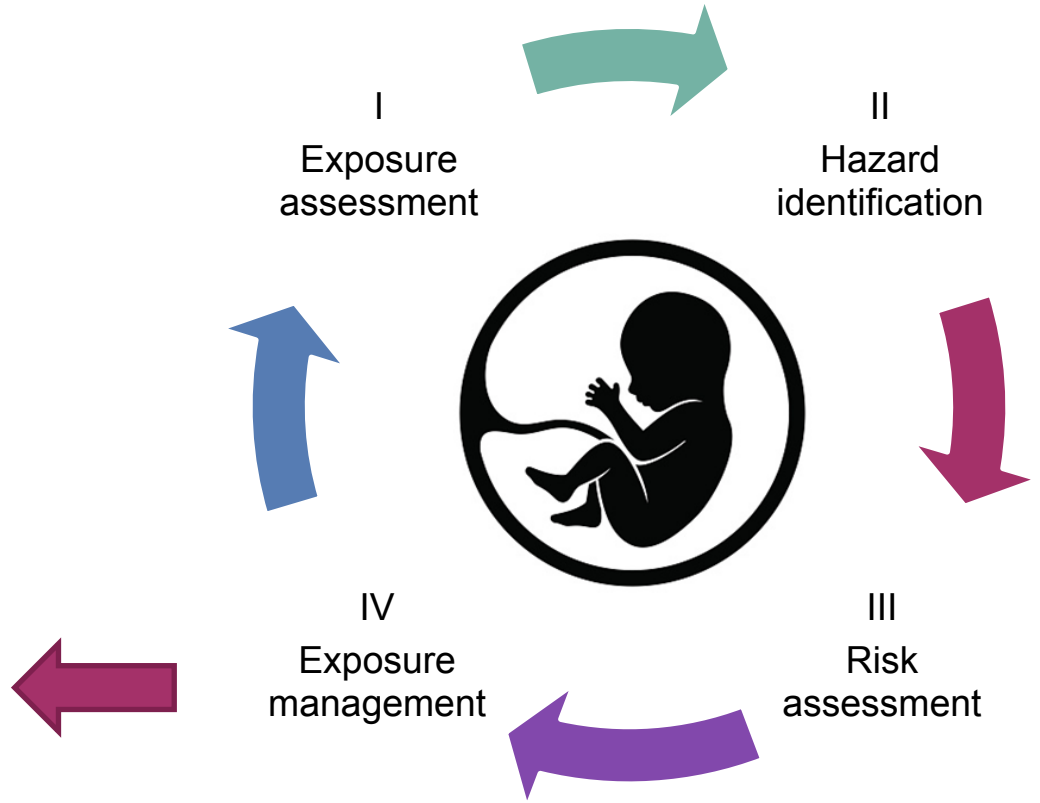
Occurrence of Polyethylene Terephthalate and Polycarbonate Microplastics in Infant and Adult Feces

Junjie Zhang, Lei Wang, Leonardo Trasande, and Kurunthachalam Kannan*

Utrecht University

Future directions





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MOMENTUM Microplastics and Human Health Consortium

www.momentummicroplastics.nl

AURORA

www.auroraresearch.eu

Multiple stressors

Environmental Science & Technology

ACS AuthorChoice

Article

Cite This: *Environ. Sci. Technol.* XXXX, XXX, XXX−XXX

pubs.acs.org/est

Method Development for Effect-Directed Analysis of Endocrine Disrupting Compounds in Human Amniotic Fluid

Hanna M. Dusza,[†] Elwin Janssen,[‡] Rakesh Kanda,[§] and Juliette Legler*[,†,∥]

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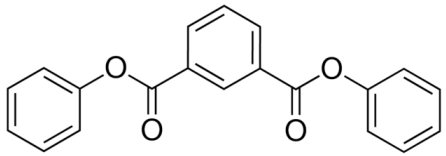
Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Identification of known and novel nonpolar endocrine disruptors in human amniotic fluid

Hanna M. Dusza[a,*], Katherine E. Manz[b], Kurt D. Pennell[b], Rakesh Kanda[c], Juliette Legler[a]



Diphenyl isophthalate

Utrecht University

Thank you!

Prof. Juliette Legler, Utrecht University, Institute for Risk Assessment (IRAS)

Prof. Dick Vethaak, Vu Amsterdam Environment and Health; and Deltares

Douglas Walker, PhD, Assistant Professor, Mount Sinai, New York, Environmental Medicine & Public Health

Eugene Katrukha, PhD, Biology Imaging Center, Utrecht University, the Netherland