XV Convegno Nazionale “Nuove Strategie di Ricerca Integrata su Salute, Alimentazione e Ambiente”

“Alimentazione e interferenti endocrini: come ridurre i rischi tossici con la dieta"

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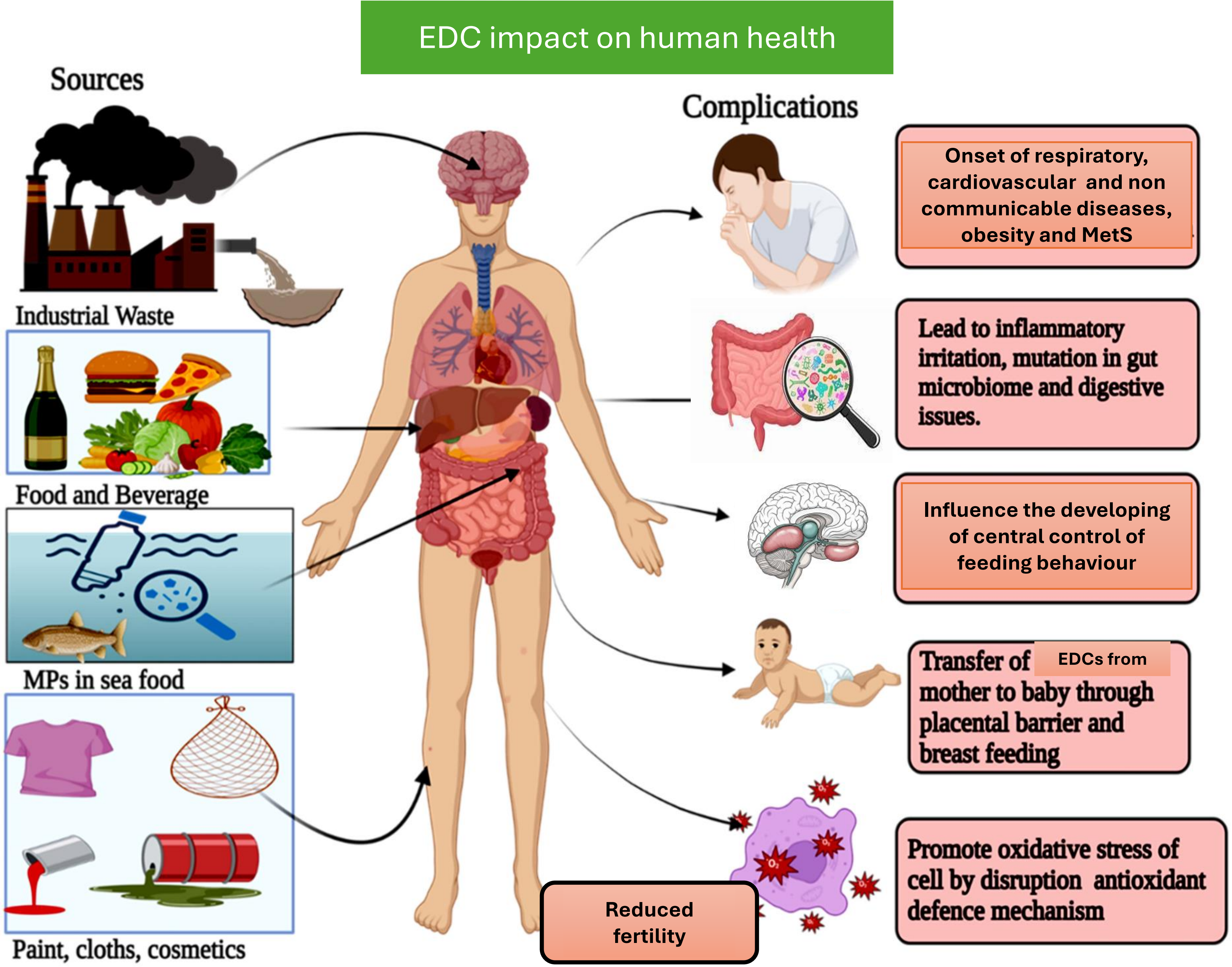
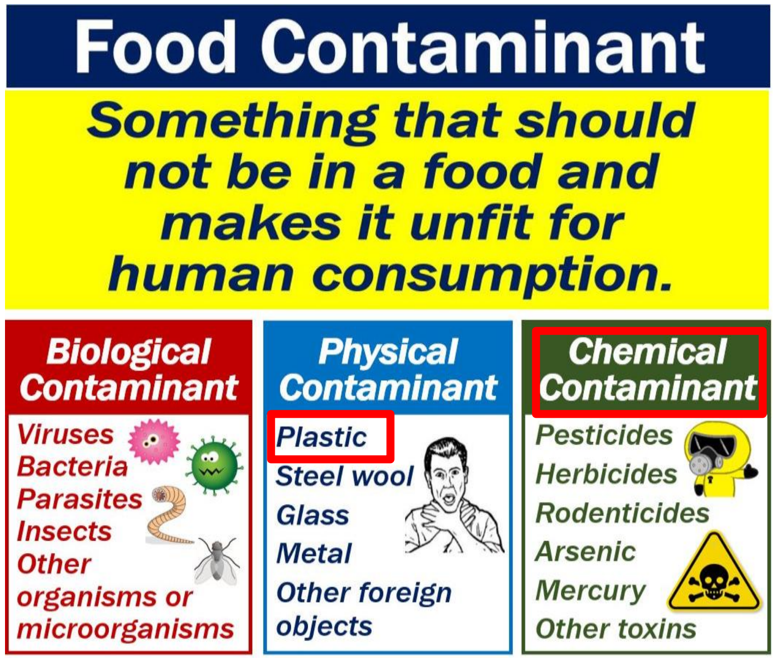
Dipartimento di Scienze della Vita e dell’Ambiente DISVA

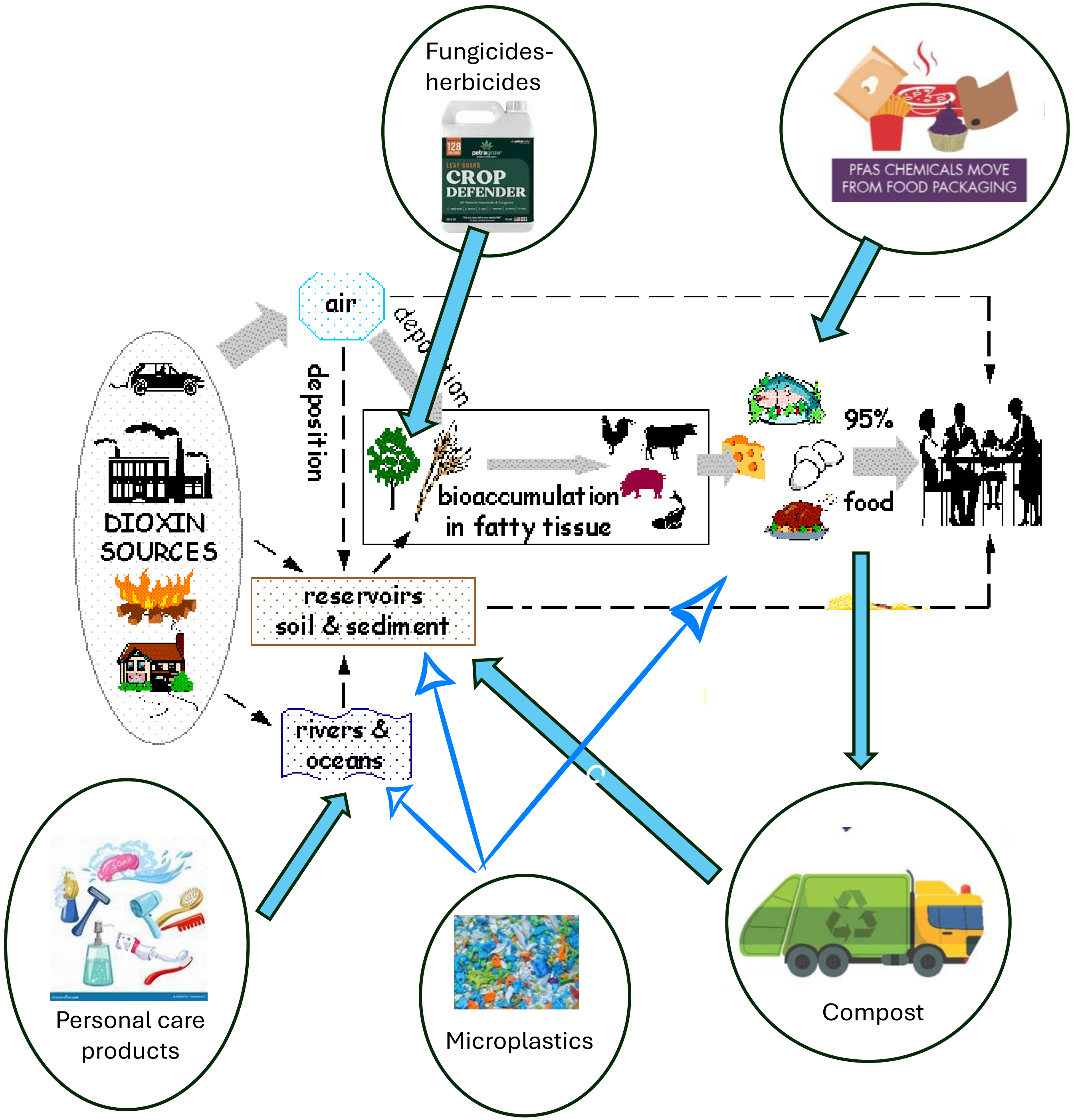
UNIVERSITÀ POLITECNICA DELLE MARCHE

Istituto Nazionale Biostrutture Biosistemi I.N.B.B. Consorzio Interuniversitario


EDC impact on human health
Sources
Industrial Waste
Food and Beverage
MPs in sea food
Paint, cloths, cosmetics
Complications
Onset of respiratory, cardiovascular and non communicable diseases, obesity and MetS
Lead to inflammatory irritation, mutation in gut microbiome and digestive issues.
Influence the developing of central control of feeding behaviour
Transfer of EDCs from mother to baby through placental barrier and breast feeding
Promote oxidative stress of cell by disruption antioxidant defence mechanism
Reduced fertility

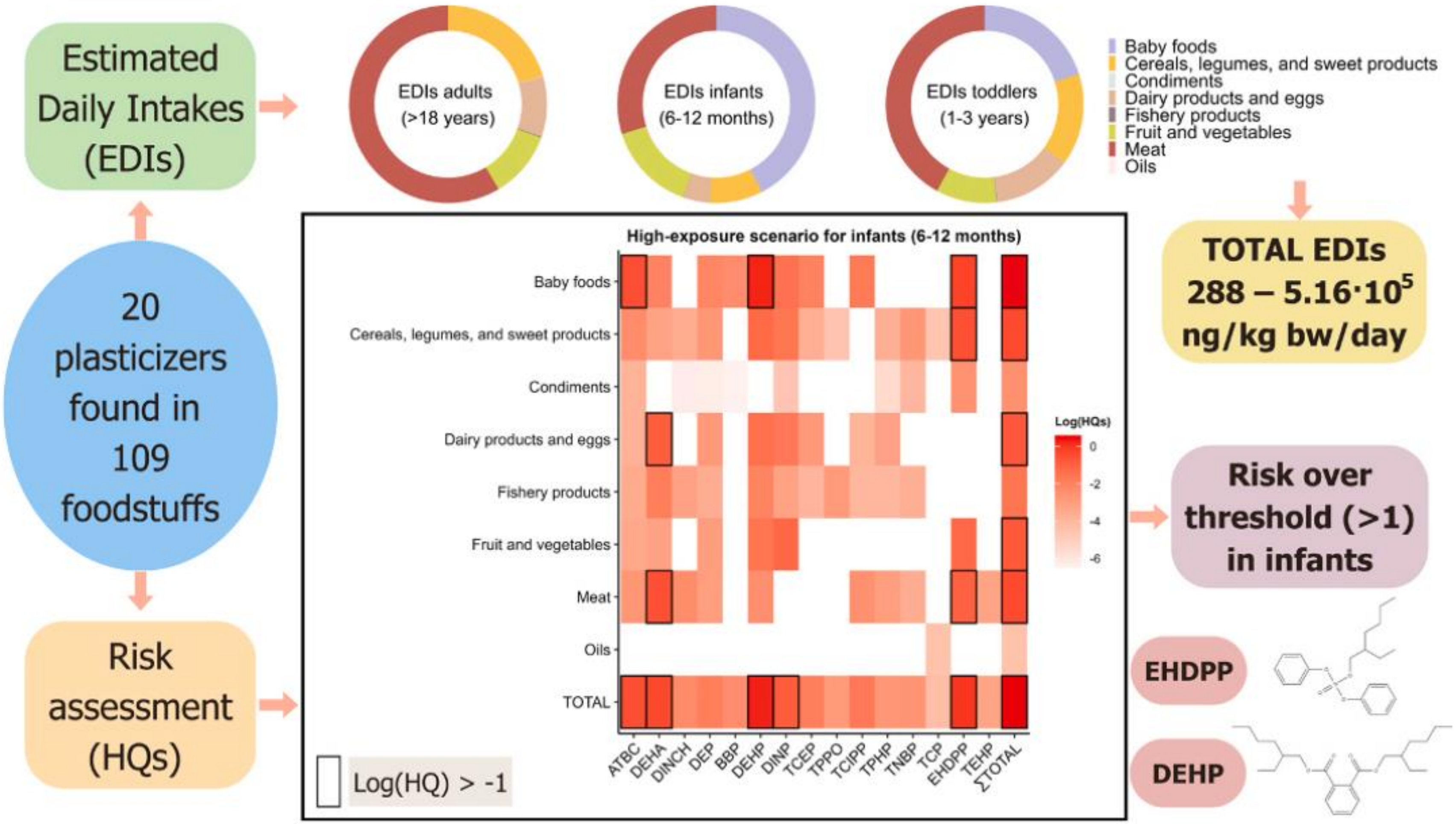


Food Contaminant
Something that should not be in a food and makes it unfit for human consumption.
Biological Contaminant
Viruses
Bacteria
Parasites
Insects
Other organisms or microorganisms
Physical Contaminant
Plastic
Steel wool
Glass
Metal
Other foreign objects
Chemical Contaminant
Pesticides
Herbicides
Rodenticides
Arsenic
Mercury
Other toxins



Fungicides-herbicides
CROP DEFENDER
PFAS CHEMICALS MOVE FROM FOOD PACKAGING
air
deposition
deposition
DIOXIN SOURCES
bioaccumulation in fatty tissue
95%
food
reservoirs soil & sediment
rivers & oceans
Personal care products
Microplastics
Compost

Plastic additives in the diet: occurence and dietary exposure in different population groups

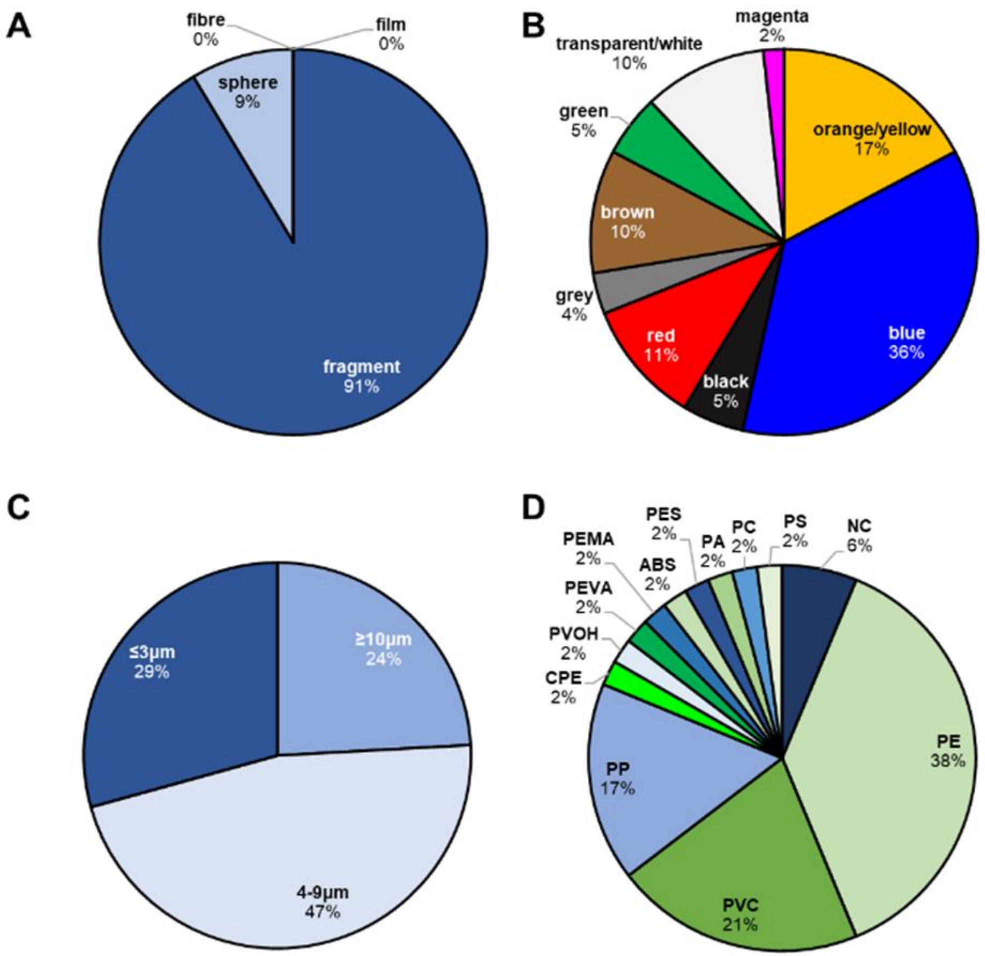


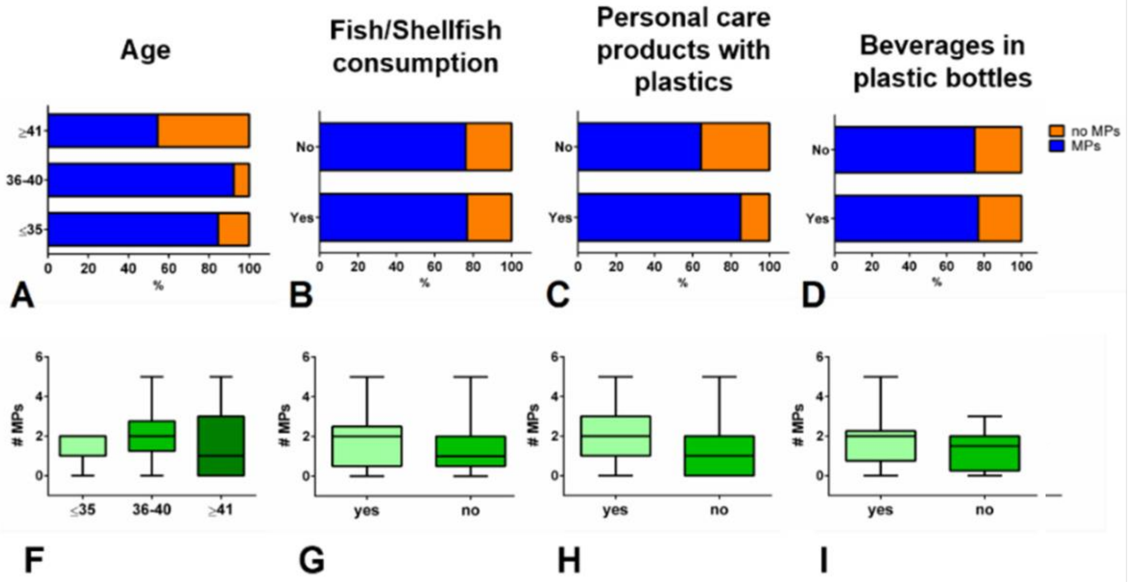
HIGHLIGHTS

- Twenty plastic additives were detected across 109 foodstuff samples.
- ATBC and DEHA were the most frequently detected non-phthalate plasticizers.
- Cooking packaged food can enhance the transference of non-phthalate plasticizers.
- Daily intake of plastic additives through diet can exceed 500 µg/kg bw/day.
- Under high-exposure scenario, DEHP surpassed the risk threshold set for infants.

Journal of Hazardous Materials 493 (2025) 138317

MICROPLASTIC IN MILK



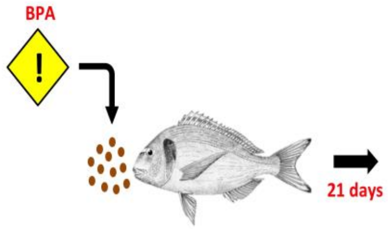


Ragusa et al., Polymers **2022**, 14, 2700. https://doi.org/10.3390/polym14132700

Diets contaminated with Bisphenol A and Di-isononyl phtalate modify skeletal muscle composition: A new target for environmental pollutant action

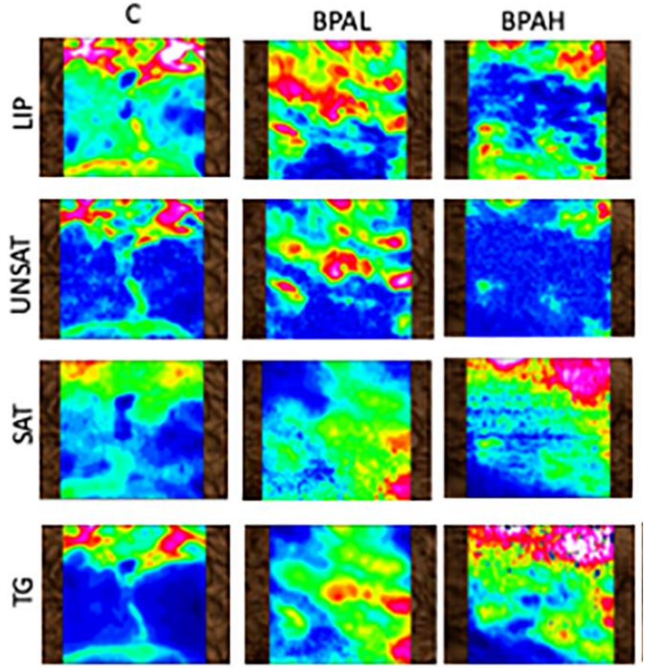
Carnevali et al., 2019

BPA
(15 and 1500 µg/kg/day)



Adult Seabream

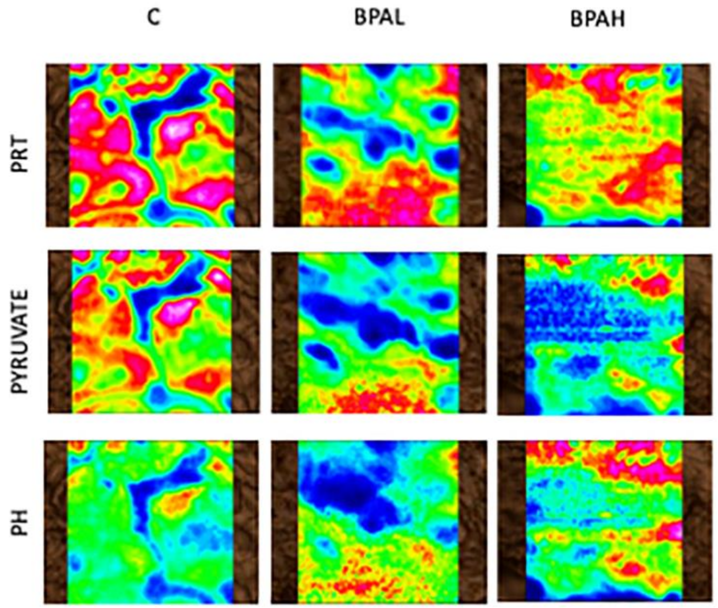
LIPID CONTENT



Ratio (a.u.)	C	BPAL	BPAH
LIP/TB	0.091 ± 0.016 (a)	0.084 ± 0.016 (a)	0.055 ± 0.008 (b)
TG/TB	0.027 ± 0.006 (a)	0.034 ± 0.006 (b)	0.059 ± 0.031 (c)
UNSAT/TB	0.0029 ± 0.0006 (a)	0.0027 ± 0.001 (a)	0.0019 ± 0.0004 (b)
SAT/TB	0.011 ± 0.001 (a)	0.016 ± 0.001 (b)	0.031 ± 0.003 (c)

Lower lipid but of worse quality

PROTEIN CONTENT



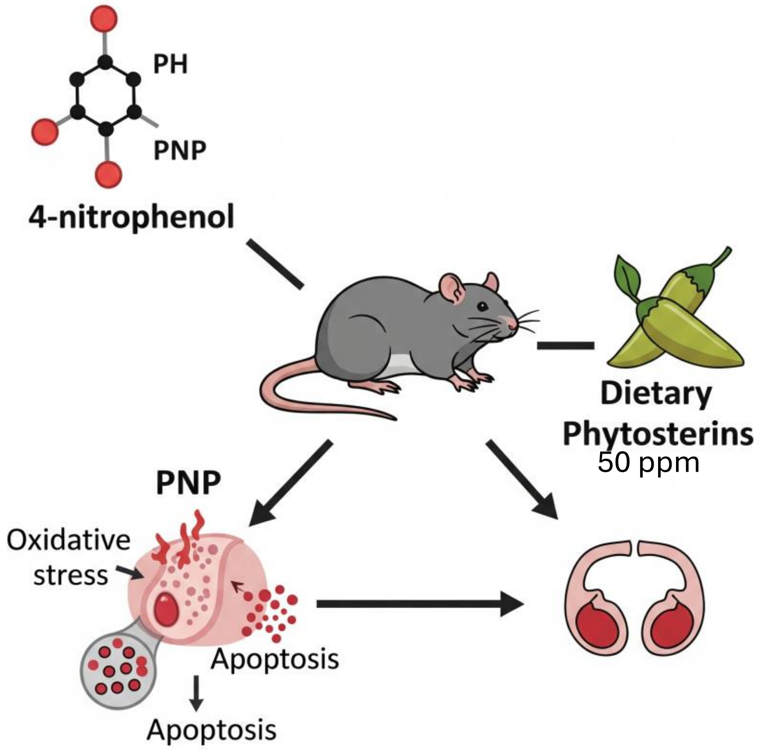
Ratio (a.u)	C	BPAL	BPAH
PRT/TB	0.460191 ± 0.015975 (a)	0.336830 ± 0.012308 (b)	0.235554 ± 0.018587 (c)
PYRUVATE/TB	0.017167 ± 0.000499 (a)	0.015153 ± 0.00095 (b)	0.005846 ± 0.002050 (c)
PH/TB	0.006754 ± 0.000235 (a)	0.009839 ± 0.000969 (b)	0.011407 ± 0.002501 (c)

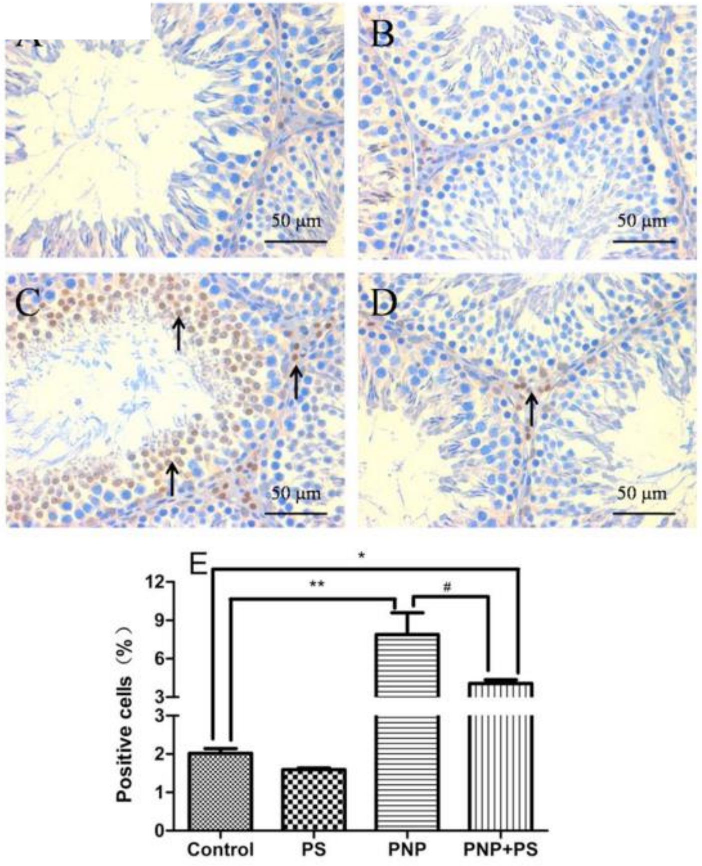
Lower protein, more phosphorilated

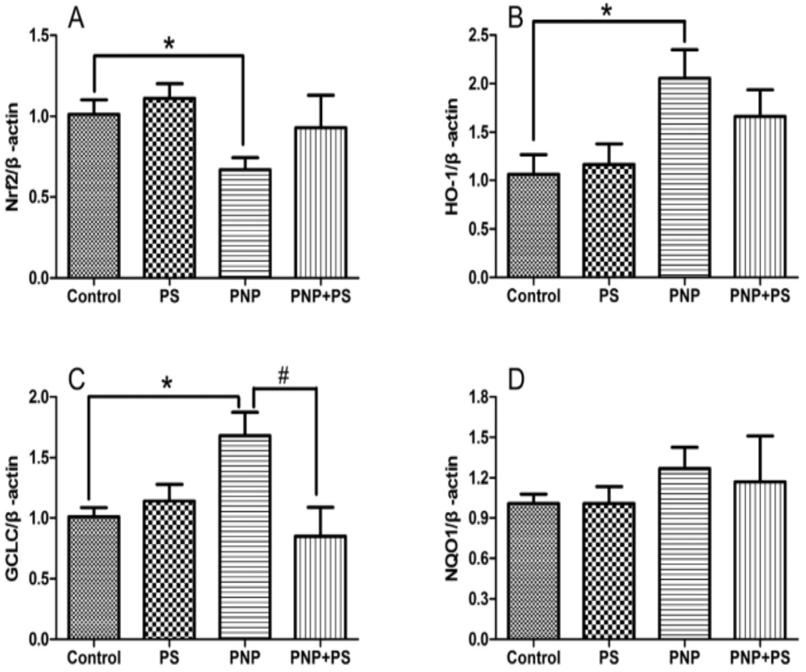
How dietary supplements can help to reduce the risks linked to EDCs?

Supplemental dietary phytosterin protects against 4-nitrophenol-induced oxidative stress and apoptosis in rat testes

Zhang et al., Toxicology reports 2020, 2 664-676







50 ppm = 3 Noci

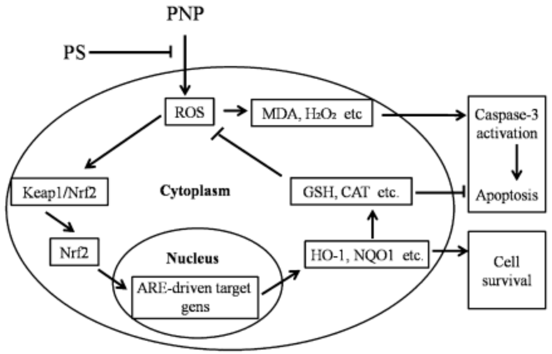


Fig. 8. Proposed model of PS-mediated protection against PNP-induced oxidative damage in rat testes.

Effect of lycopene on environmental toxicity and pollution induced by PFOS

Yinni He[1,*], Juan Tang[1] and Qingguo Liu[2]

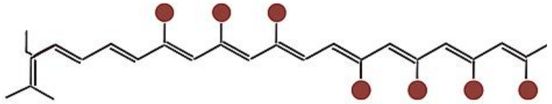
[1]School of Medicine, Shaoyang University, Shaoyang, Hunan Province, China
[2]Department of Histology and Embryology, Changsha Medical University, Changsha, Hunan Province, China

doi:10.1088/1755-1315/804/4/042070

PFOS
(32 mg/kg)

(Perfluorooctanesulfonic acid)

PFOS+
LP (10-20 mg/Kg)



Lycopene

Sperm motility ↑

LDH-X, T ↑
SOD, CAT ↑
MDA

Pomodoro fresco 3–7mg/100 g

Salsa di pomodoro (cotta) 10-30 mg/100 g)

Table 1. Effects of lycopene on the number, motility and deformity rate of spermatozoa in exposed rats (n=30, $\bar{x}$±s)

Group	Sperm count (10^7/g epididymis)	Activity rate (%)	Deformity rate (%)
Solvent control group	16.87±0.64	72.65±7.31	1.29±0.15
PFOS group	13.67±1.81#	34.98±4.75#	2.56±0.35#
Low LP group	14.91±0.79*	44.00±3.74*	2.43±0.56#
Middle LP group	15.44±1.06*	53.68±7.11*	1.82±0.47*
High LP group	16.13±0.78*	68.37±9.22*	1.81±0.26*

*: Compared with PFOS group, P<0.05;
#: Compared with the solvent control group, P<0.05

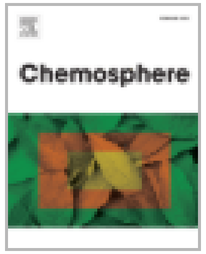
Table 3. Effects of lycopene on SOD, CAT and MDA in testicular tissue of rats (n=30, $\bar{x}$±s)

Group	MDA(nmol/gPro)	SOD(U/mgPro)	CAT(U/mgPro)
Solvent control group	0.71±0.10	57.08±6.36	18.26±1.95
PFOS group	1.88±0.32#	35.00±4.75#	12.12±1.95#
Low LP group	1.48±0.17*	38.63±4.90*	15.61±1.81*
Middle LP group	1.36±0.23*	44.69±5.13*	16.59±3.65*
High LP group	1.25±0.25*	49.95±5.15*	17.04±2.63*

*: Compared with PFOS group, P<0.05;
#: Compared with Solvent control group, P<0.05

Natural-based solutions to mitigate dietary microplastics side effects in fish

N. Cattaneo [a][1], M. Zarantoniello [a][1], F. Conti [a], A. Tavano [a], A. Frontini [a], I. Sener [a], G. Cardinaletti [b], I. Olivotto [a]

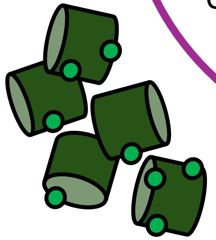


STEP 1: 6-month feeding trial with diets containing MPs

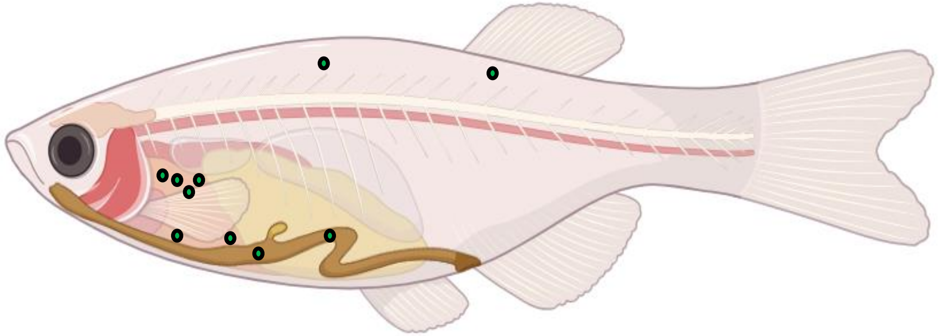
From swimming larvae (5 dpf)

6 months

To adult stage

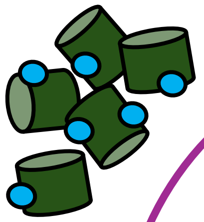


Amino formaldehyde - AFP (1-5 μm)



microbeads were absorbed at gut level and then translocated in liver, causing oxidative stress (dose-dependent effect)

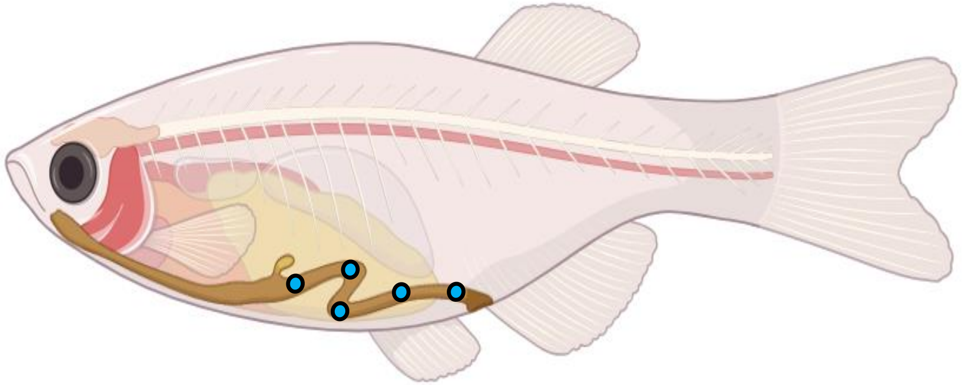
Polyethylene (40-47 μm)



To adult stage

6 months

From swimming larvae (5 dpf)

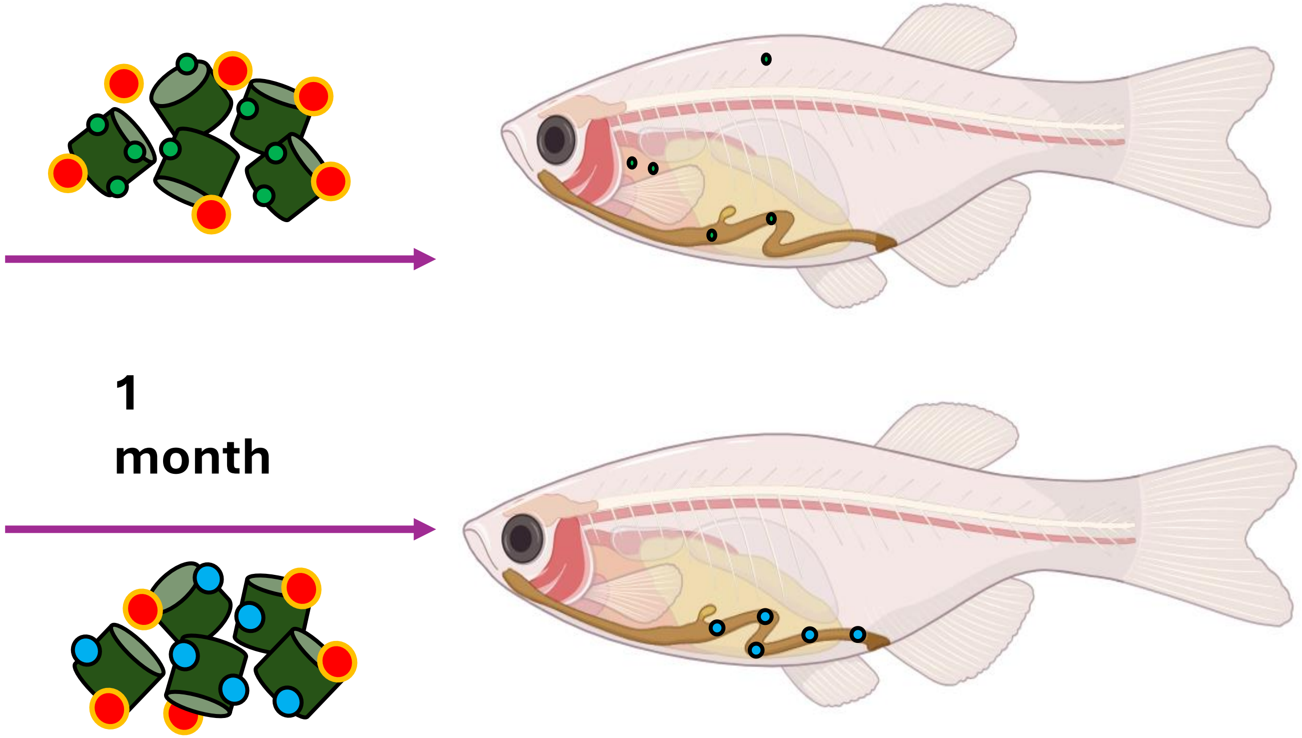


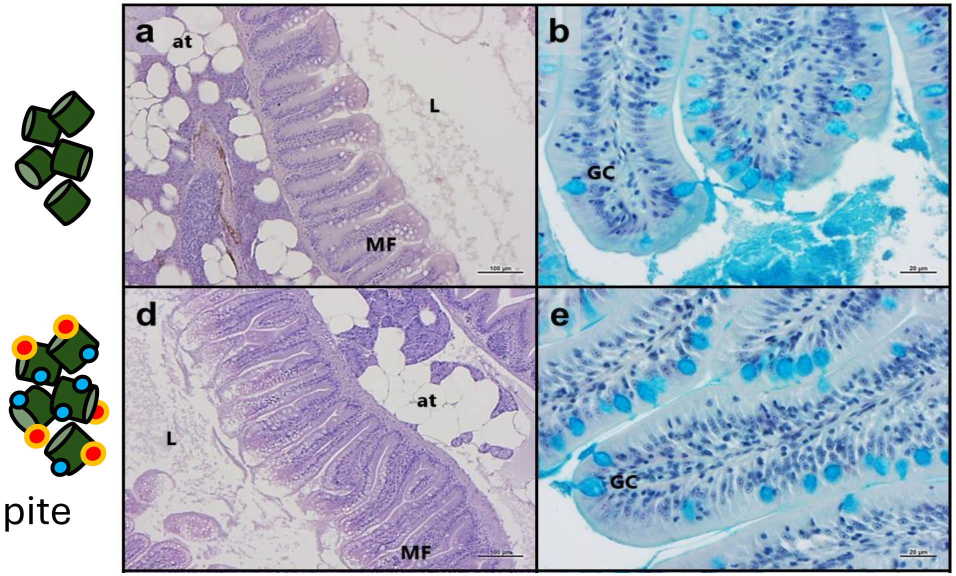
Polyethylene microbeads simply transited through fish gut causing an abrasive effect

STEP 2: Testing diets implemented with microincapsulated AX for 1 month

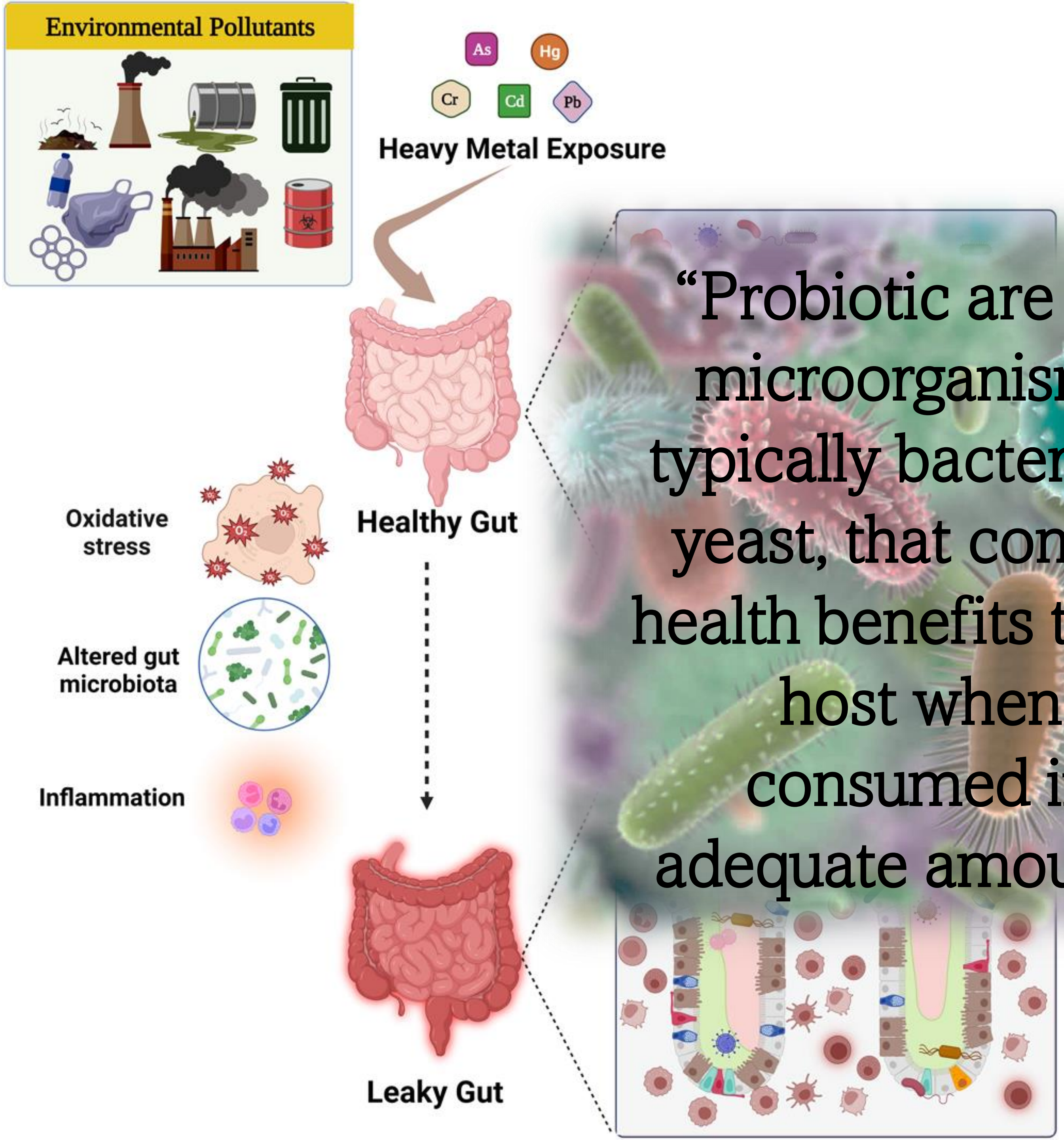
Microincapsulated ASX reduced MPs accumulation in target organs (only in fish exposed to the 500 mg/kg dietary concentration)

Polymer A (1–5μm)						
	CTRL	CTRL-ASX	A50	A50-ASX	A500	A500-ASX
Intestine	0	0	2.9±0.3 [a]	2.6±0.9 [a]	170.9±20.6 [c]	20.5±2.5 [b]
Liver	0	0	5.5±1.7 [a]	5.5±2.1 [a]	821.1±95.5 [b]	12.2±3.0 [a]
Muscle	0	0	2.0±0.2 [a]	1.9±0.9 [a]	48.0±4.3 [b]	3.2±1.8 [a]





Microincapsulated AX restored the intestinal architecture and overall welfare, despite the transit of polyethylene microbeads



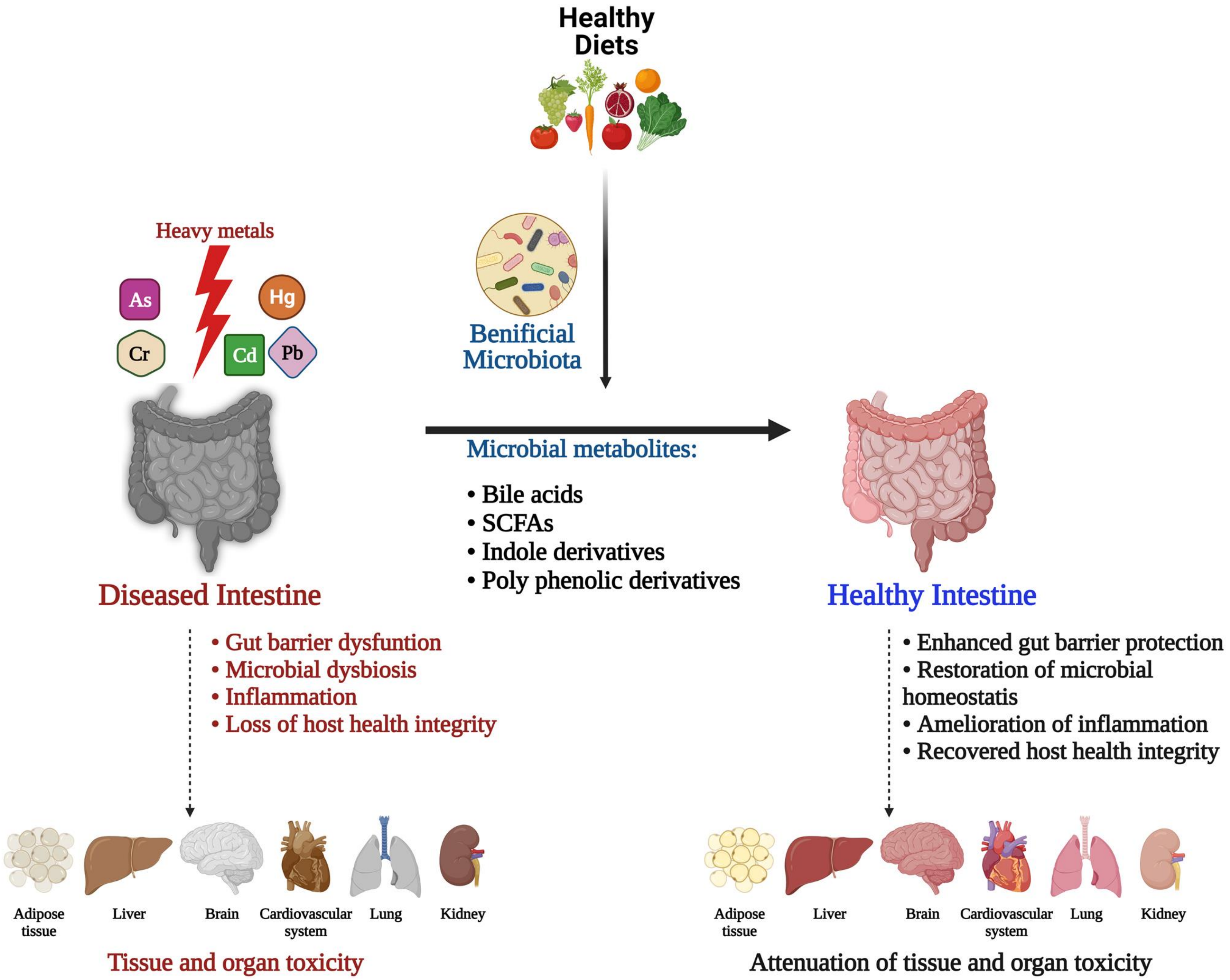
"Probiotic are live microorganisms, typically bacteria or yeast, that confers health benefits to the host when consumed in adequate amounts"

Microbiota and Host (2024) 2 e230015
https://doi.org/10.1530/MAH-23-0015

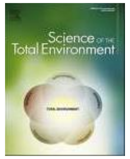
...ects of heavy metals on host health and gut microbiota.

		Changes in Gut microbiota	
	Effect on health	Increase	Decrease
	Pathological changes in skin; gut barrier dysfunction; inflammation; carcinogenesis; microbial dysbiosis; cardiovascular diseases	Bacteroidetes, *Bifidobacterium*, *Faecalibaculum*, Enterobacteriaceae, Gammaproteobacteria	Firmicutes, Enterobacteriaceae
	Increased bodyweight; reduced MUC2, ZO-1, occludin, and claudin 1; increased gut permeability; elevated oxidative stress and inflammation; dysregulated hepatic metabolism; microbial dysbiosis; hepatotoxicity; nephrotoxicity	Bacteroidetes, Clostridiaceae, Ruminococcus, Oscillibacter, Parabacteroides, Desulfovibrionaceae, *Clostridium* XIVb, *Barnesiella*	Firmicutes, Proteobacteria, *Turicibacter*, Akkermansia, Dehalobacterium, *Lactococcus*, *Enterorhabdus*, Caulobacterales
	Neurotoxicity, oxidative stress and inflammation, leaky gut, mitochondrial dysfunction, increased lipid peroxidation, altered calcium homeostasis	Firmicutes/Bacteroidetes ratio, *Akkermansia*	*Lactobacillus*, Proteobacteria
	Inflammation; microbial dysbiosis; intestinal damage; junctional protein, mucus and glycan distribution alteration; hepatotoxicity; energy metabolism dysregulation; endocrine disruption; genome instability	Bacteroidetes, *Akkermansia muciniphila*, *Prevotella* spp., *Escherichia coli*, *Shigella*	Firmicutes, γ-Proteobacteria, *A. muciniphila*, *Clostridium cocleatum*, *Lachnoclostridium*
Chromium	Oxidative stress, cancer, GI distress, microbial dysbiosis, DNA damage, lipid peroxidation, liver toxicity	Bacteroidetes, Tenericutes, *Prevotella*, *Clostridiales*, S24-7, Actinobacteria	Firmicutes, Lachnospiraceae

Ghosh et al., 2024 . *Microbiota and Host. 2(1):e230015. doi:10.1530/MAH-23-0015*

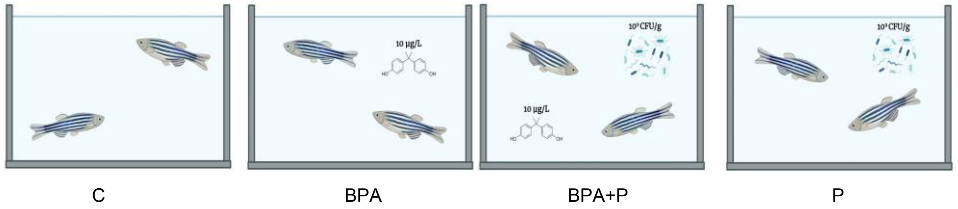


Ghosh et al., 2024 . *Microbiota and Host. 2(1):e230015. doi:10.1530/MAH-23-0015*



The probiotic SLAB51 as agent to counteract BPA toxicity on zebrafish gut microbiota -liver-brain axis

Giommi et al., 2024, STOTEN

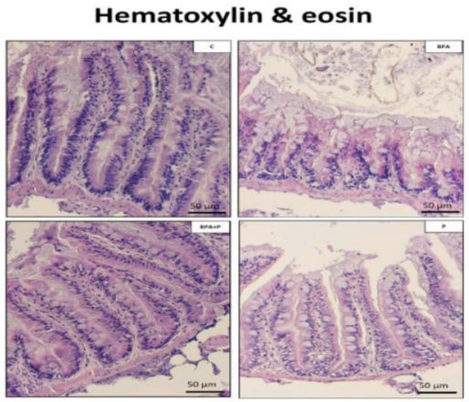


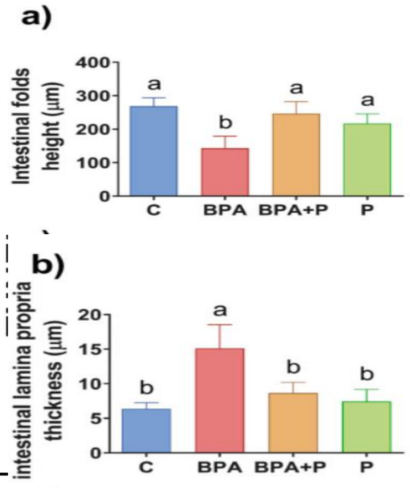
28 days

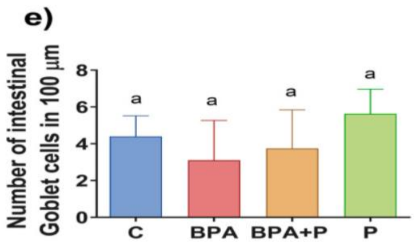
P: SLAB51 multi-strain probiotic formulation commercialized by Ormendes SA with the name of SivoMixx®

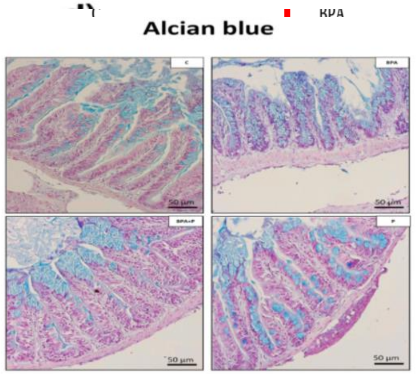
Gut

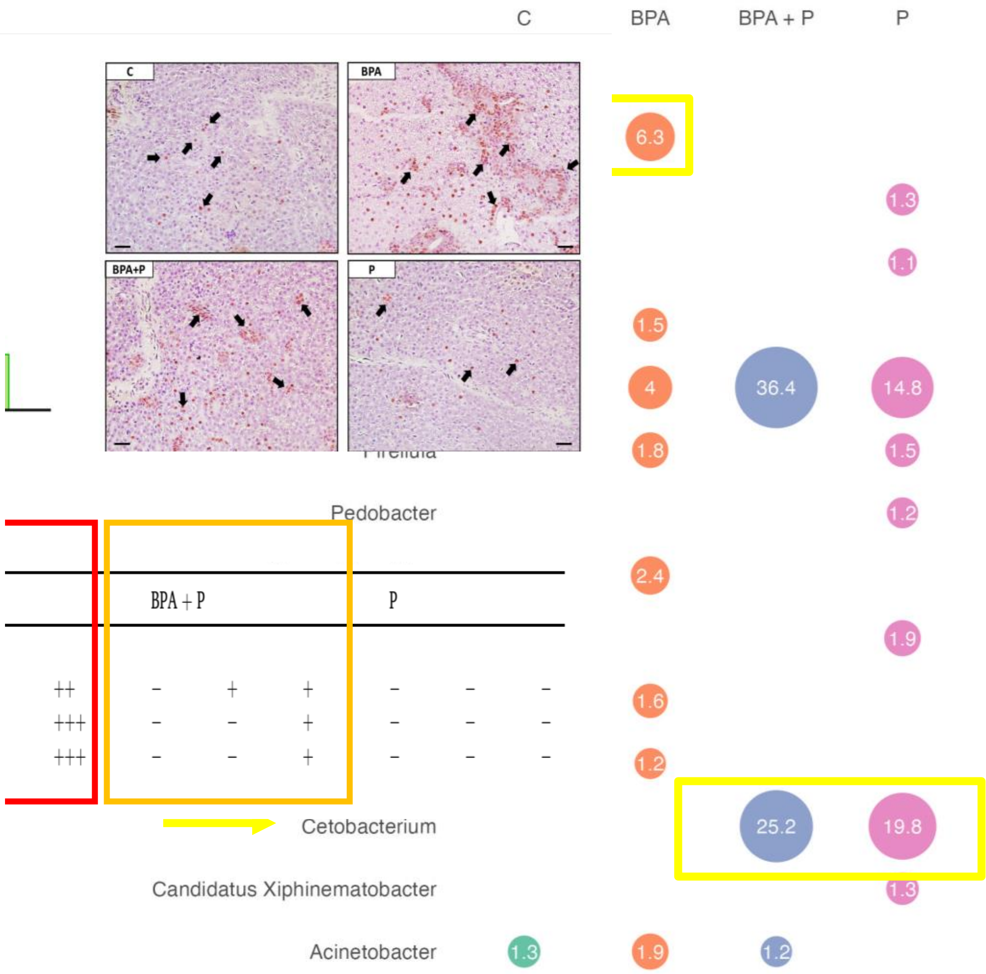
Liver

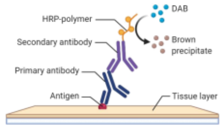






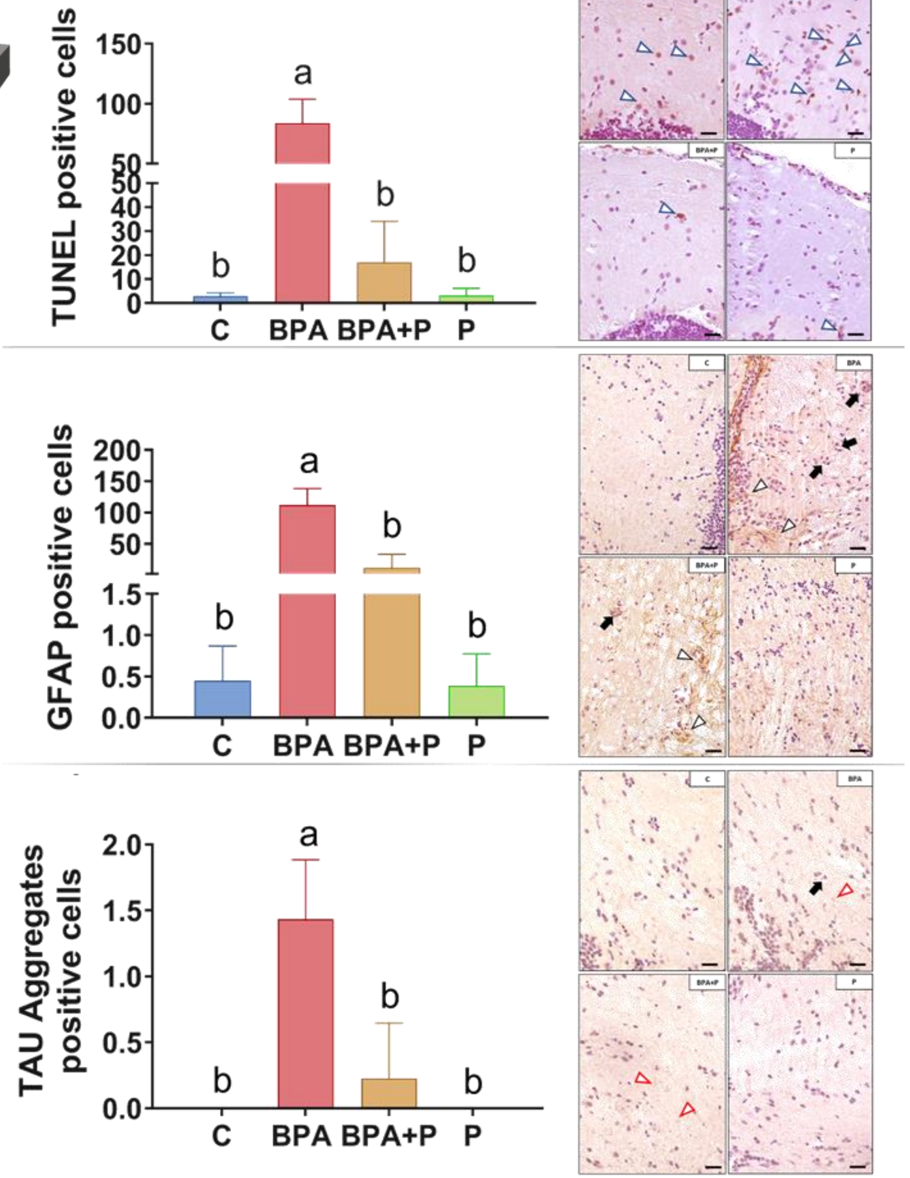


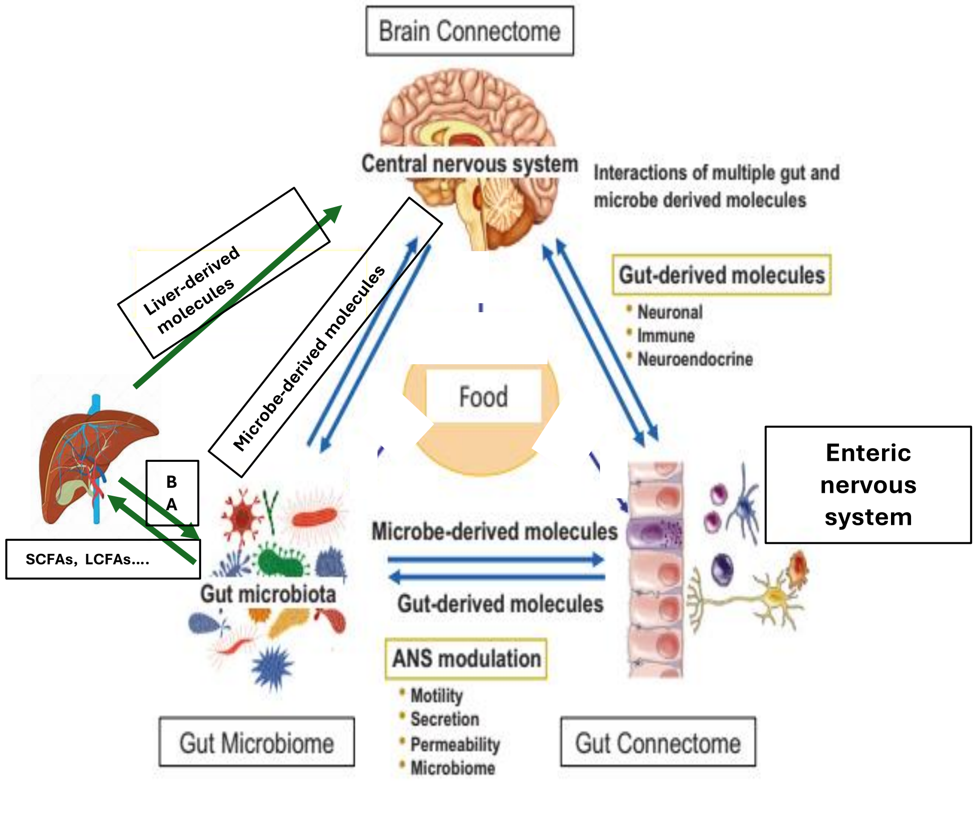




TUNEL and TAU and GFAP immunostaining

Brain

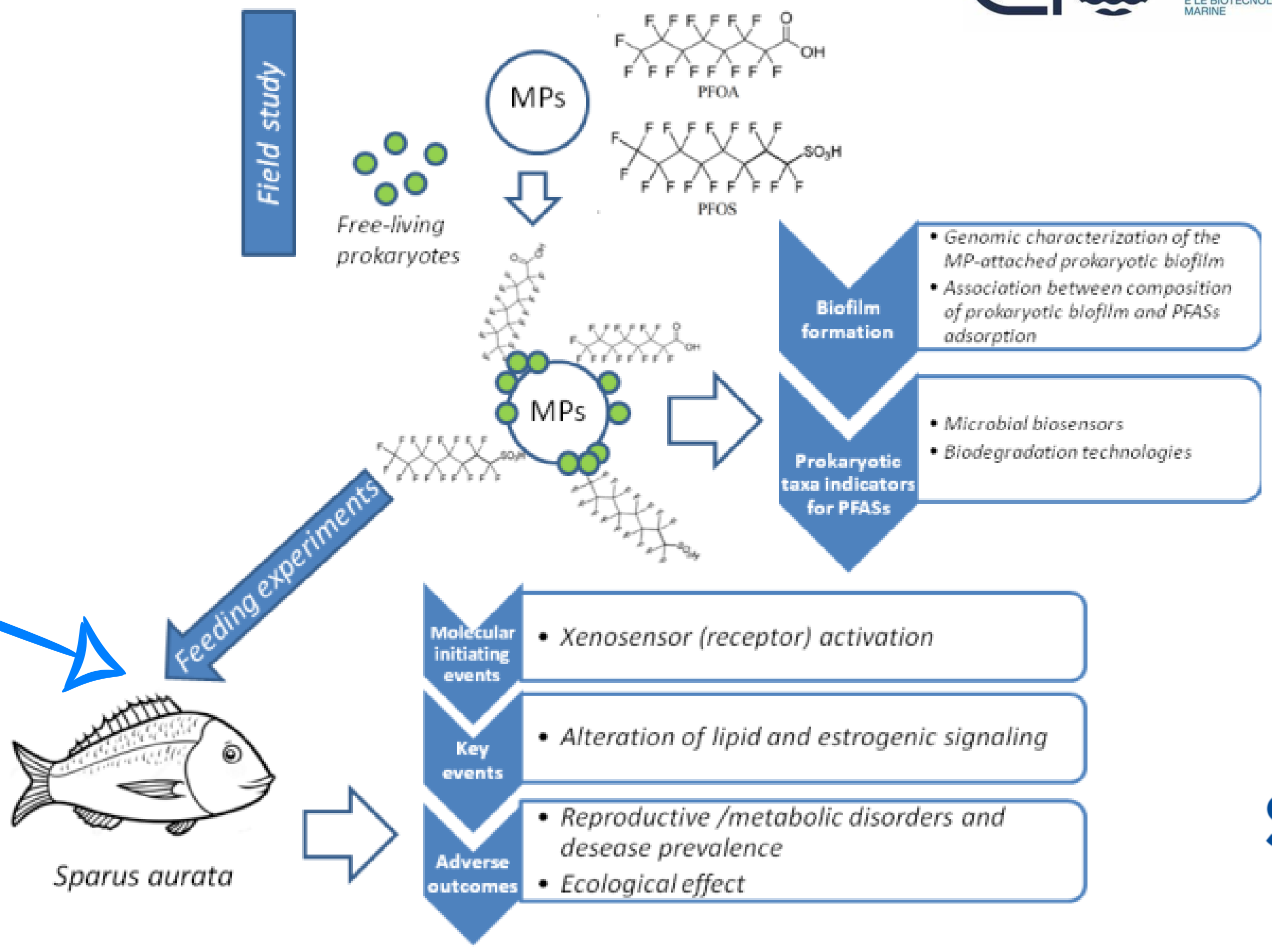




Adapted from Horn et al., 2022

- Totally counteracts BPA gut toxicity
- Reduces *Staphilococcus* levels and favors the colonization of *Cetobacterium*
- *Partially Counteracts Liver damage*
- Totally mitigates brain toxicity

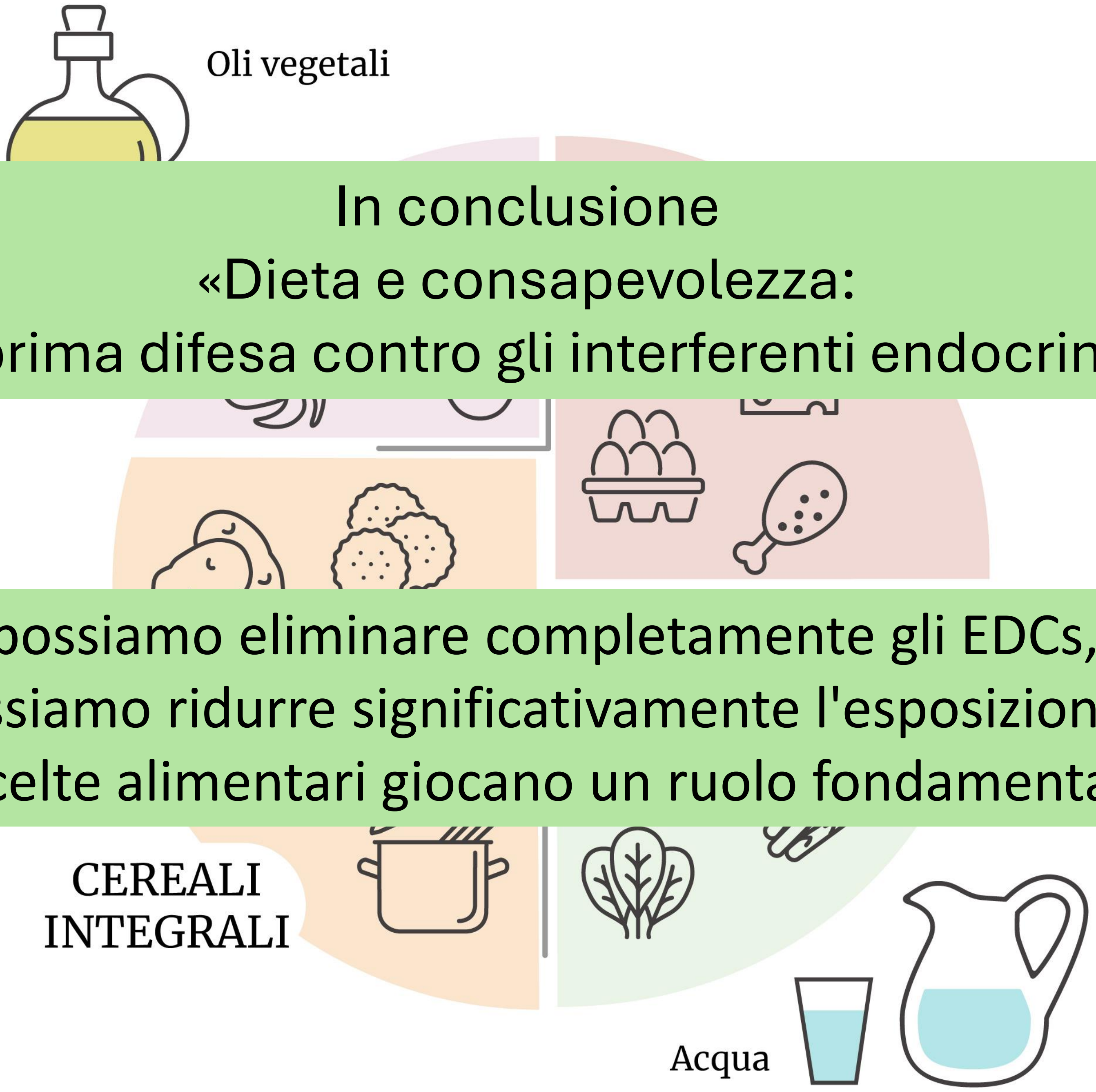
EnviroNmEntal and health impact
Of PerfluoroaLkylated SubstAnces
(PFAS) associated with microplaStics
in a coasTal area of theCentral
AdrIatiC Sea (Italy) (NEOPLASTIC)



SynbioTec spin-off LABORATORI

AQUASERV

In conclusione
«Dieta e consapevolezza:
la prima difesa contro gli interferenti endocrini»

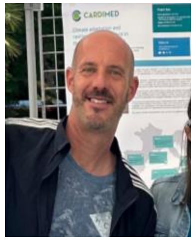


Non possiamo eliminare completamente gli EDCs, ma possiamo ridurre significativamente l'esposizione.
Le scelte alimentari giocano un ruolo fondamentale.

Thank you for your attention!

ACKNOWLEDGMENTS

Prof Oliana Carnevali
DiSVA



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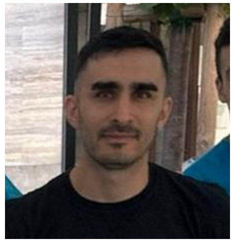

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Dipartimento di Scienze della Vita e dell'Ambiente
DISVA

Ragazzi del Laboratorio di Biologia dello Sviluppo e della Riproduzione

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