Defining the size ranges of polystyrene nanoplastic according to their ability to cross biological barriers

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Table S1. Adverse effects of different sizes of nanoplastics on biological barriers

Biological barriers	Species	Plastic type	Particle size / Exposure concentration dose	Effects	References
Blood–brain barrier	Mice	Polystyrene particles	80, 100, 200 nm, 10 μg/ml	80 nm particles can be inhaled through the nasal cavity via atomization and then deposited into the brain, 100 nm and 200 nm particles cannot pass the blood–brain barrier.	(Liu et al. 2022b)
Intestinal barrier	Mice	Polystyrene particles	50 μm, 100 and 1000 μg/L	Do not pass the intestinal barrier, decrease the secretion of mucin in the mouse gut.	(Lu et al. 2018)
		Polystyrene particles	5 μm, 100 and 1000 μg/L	Detected in the intestinal tract, impact of exposure of offspring to maternal microplastics is related to particle size.	(Luo et al. 2019)
		Polystyrene particles	1, 4 and 10 μm, 4.55×10^7 particles and 1.49×10^6 particles	Mice not observed to have inflammation nor oxidative stress.	(Stock et al. 2019)
		Polyethylene particles	10-150 μm, 6, 60 and 600 μg/day	Increases intestinal microbial alpha and beta diversity; intestinal inflammation is observed; does not cross the intestinal barrier.	(Li et al. 2020)

	———	Polystyrene particles	5 μm，500 μg/L	Intestinal immune imbalance increases the accumulation and adverse effects of polystyrene microplastics in the intestine.	(Liu et al. 2022a)
Placental and blood-testis barrier	Mice	Polystyrene particles	0.8 μm, 30 mg/ kg body weight/d	Polystyrene microplastics exposure increases the IL-6 level and decreases the malondialdehyde level in mouse ovaries; particles cannot enter the placental barrier.	(Liu et al. 2022c)
	Mice	Polystyrene particles	5 μm, 10^5, 10^6 and 10^7 ng/L	Polystyrene microplastics exposure significantly reduces the number of viable epididymis sperm, increases the rate of sperm deformity. Polystyrene microplastics exposure results in no significant change in body weight, cannot pass the blood-testis barrier.	(Hou et al. 2021)

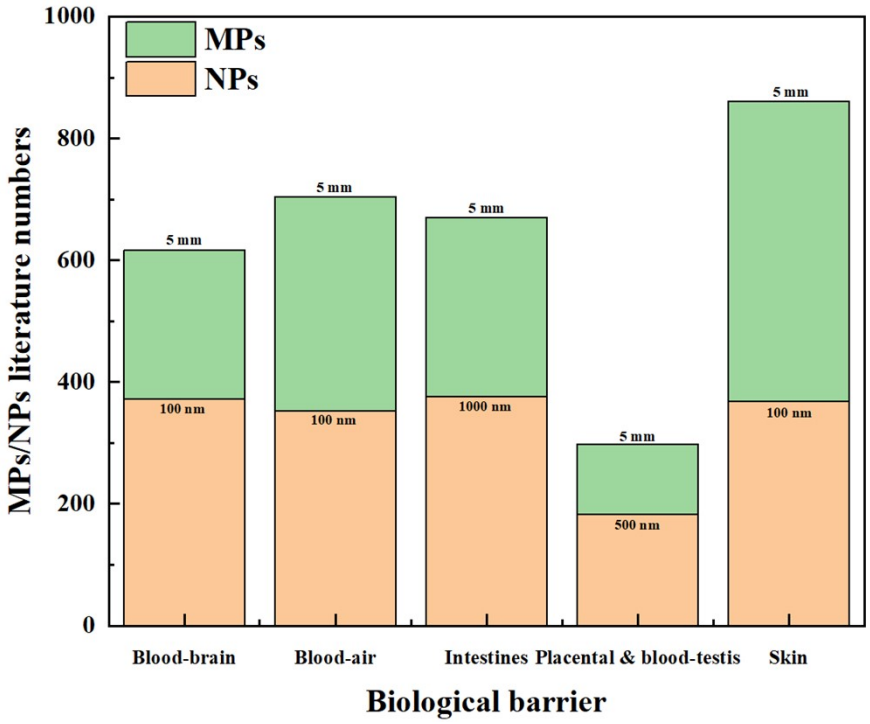

Figure S1. Defining the ecotoxicity ranges of different nanoplastic particle sizes on biological barriers according to the literature. The numbers of studies on MPs/NPs from 2005 to 2023 are summarized. Orange bars represent the number of studies on the definition of nanoplastic particle size that passes through biological barriers, as discussed **in the conclusion.** Green bars represent the number of studies on microplastics measuring less than 5 mm, excluding nanoplastics that can pass through biological barriers. MPs: microplastics, NPs: nanoplastics.

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