Nanomaterial safety for microbially-colonized hosts: Microbiota-mediated physisorption interactions and particle-specific toxicity

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Propositions accompanying the dissertation:

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and particle-specific toxicity

By Bregje Brinkmann

1. Pathologies that are caused by nanomaterial-induced shifts in the taxonomic composition of host-associated microbiota are an example of microbiota-dependent adverse outcomes for nanomaterials.
(**Chapter 1**, this thesis)

2. Insight into the differences between the adsorption affinities of microbial metabolites to carbon and metal nanomaterials can contribute to more accurate nanomaterial safety prediction.
(**Chapter 2**, this thesis)

3. Collisions between nanoparticles and microbes can come at the expense of increased dispersal of pathogenic bacteria through aquatic ecosystems, and across different life stages of oviparous animals.
(**Chapter 3**, this thesis)

4. Interactions between microbiota and toll-like receptors can protect microbially-colonized hosts against particle-specific nanomaterial toxicity.
(**Chapter 5**, this thesis)

5. "The nanoscale is in many respects the 'natural' length scale of biology" (Dawson and Yan 2021; Nat Nanotechnol. 16, p. 229). Nonetheless, nanoscale processes can be experienced at a length scale that is up to sixteen orders of magnitude larger.

6. ‘From a scientific point of view all progress in unravelling mechanisms by means of model analyses and clever experiments is worthwhile’ (Scheffer, 2004; ‘The ecology of shallow lakes’, p. 310). From a toxicological point of view, this moreover forms a valuable basis for predicting the effects of substances that have not yet been tested in a lab or field setup.

7. The fact that members of colonizing microbiota are ‘sitting at the interface between a host and its environment’ (Duperron et al. 2020; Front Public Health 8, p. 407), including skin, lung, gill and gastrointestinal epithelia, underscores the importance to consider the interactions between microbes and environmental pollutants in toxicology.

8. Especially the ‘ancient’ responses of vertebrate hosts to ‘compositionally distinct microbial communities’ and ‘distinct microbial species’ (Rawls et al. 2006; Cell 127, p.423) can be implemented in cross-species extrapolation strategies for microbiota-inclusive toxicology.

9. The contribution of animal caretakers to the welfare of laboratory animals and their researchers is of key importance to the reproducibility of scientific investigations.

10. As described by the Dunning-Kruger Effect, scientific investigations, and any other exploration of the unknown, include many hours of climbing the Slope of Enlightenment following a fall from Mount Stupid into the Valley of Despair.

11. The motto ‘First in, last out’ (O’Neill) captures what wetsuits mean to North Sea (kite)surfers, and describes how PhDs candidates thrive in the lab.

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