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Pathogen-nanomaterial crosstalk: Principles and relevance of nanoantibiotics

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Nanomaterials have dramatically increased in functionality and complexity, potentially allowing also unprecedented control over microbial pathogens, such as bacteria, fungi or viruses. From these advances arises the prospect of novel nanomaterial-based antimicrobial therapies, which clearly differ from their bulk counterparts. Yet, practi¬cal constraints require a rational understanding of NMs' physicochemical characteristics and parameters at the nano-bio interface that impact their antimicrobial activity. We here define the most important nanomaterial parameters and biological outputs enabling controllable antimicrobial activity, while minimizing the complexity of designs. We present the problematic of nanomaterial resistance and mechanistic strategies to overcome these current limitations for next-generation practical applications. The presented insights will inspire nanomaterial designs that maximize functionality and safe translatability as new nanoantibiotics and deepened our understanding on the biomedical and ecological relevance of nanomaterial-microbiota cross-talk in general.

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