

## **Biogeochemistry of natural and engineered nanomaterials**

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Natural, incidental, and engineered nanomaterials in aquatic systems, soils, and the atmosphere, including both solids and natural organic matter, are ubiquitous and have a profound impact on the environment. Because of their high surface area and reactivity, they are the most important sorbents in the biosphere and have chemical and physical properties that differ from their bulk counterparts in many ways. We will present an overview of the most important types of natural, incidental, and engineered nanoparticles in the environment, their stabilities in the presence of aqueous solutions and atmospheric gases, their environmental transformations, sorption reactions, and interactions with microorganisms, and their impact on the health of organisms. The structures, properties, and reactivities of the natural nanomaterial ferrihydrite and the engineered nanoparticles silver, ZnO, and CuO will be discussed. Once introduced into the environment, engineered nanomaterials may undergo compositional and structural transformations that have a major impact on their properties. In addition, when natural nanoparticles are transferred into environments that impact their stability, they also undergo transformations that can impact their properties. Examples of these transformation will be presented and major unanswered questions will be discussed.