

## **Microscopic Molecular Foundations of nano particle interactions with living systems**

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It has been of interest to find guiding principles to help us understand how nanoscale objects interact with living organisms. Firstly, the nanoscale is unique in biology, and our capacity to engineer on that scale is transformative. The intrinsic machinery of biology is defined and operates on the nanoscale. This means that nanoparticles are also actively transported around cells and biological barriers all unlike small molecules which passively partition into biological compartments (cells, organs, etc.). Secondly, the power of being able to communicate with, and use those endogenous mechanisms of biology is potentially transformative in practical terms.

However, with this enormous potential power to engage with the machinery of organisms there are also challenges. To some degree, the challenge, of this field may have been underestimated, and only now are we beginning to face the need to invest in guiding principles and governing principles the whole arena.

We discuss progress being made in understanding how interactions between nanoscale objects and living organisms occur, and their governing principles. [2, 3] We argue that the future lies in pressing forward to develop a truly microscopic (molecular scale) understanding between the nanoscale and living organisms. [4]

### **References**

- [1] Nature nanotechnology, 2012, 7, 779-786
- [2] Nature nanotechnology, 2012, 7, 62-68
- [3] Nature Nanotechnology, 2015, 10, 472-479
- [4] Nature Communications, 2016 (December)