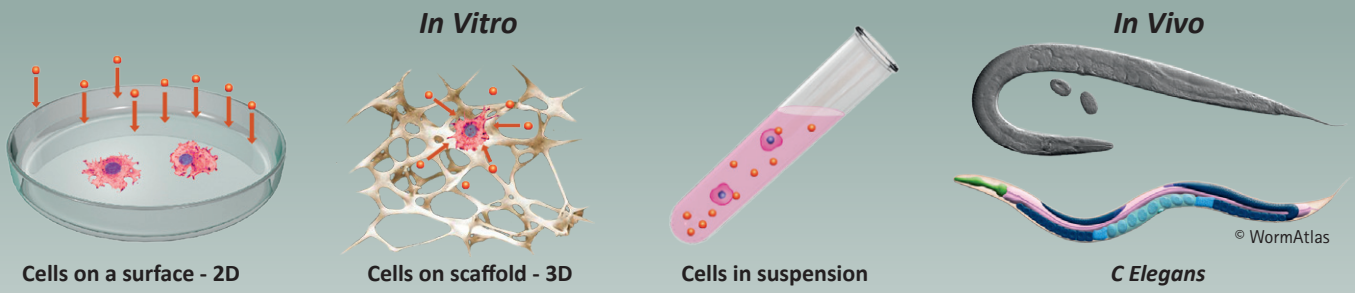
Evaluating the biological effects of nanoparticles is a hugely complex task, and it is not commonly performed in great depth and in a cost-efficient manner. The 3DinvitroNPC project has exploited a 3-dimensional method of assessing the viability and functionality of nanoparticles for medical applications, as **Dr Anna Laromaine** explains



New dimension in nanoparticle research

Nanoparticles are increasingly used in medicine today, with applications in drug delivery, medical imaging and *in vitro* biosensors, to name just three areas. These nanoparticles need to be thoroughly characterised before they can be used in biomedical applications, an issue that lies at the core of the 3DinvitroNPC project. "The idea behind the project is that instead of evaluating nanoparticles on a 2-D cell culture, we will develop 3-D biological approaches," explains Dr Anna Laromaine, the project's Principal Investigator. This will provide a more realistic environment to test nanoparticles and assess their likely effects than existing methods. "With a 3-D cell culture, we could evaluate questions like how nanoparticles interact with cells, how they aggregate, whether they degrade, and how they interact with membranes," outlines Dr Laromaine.

Nanoparticle testing

The core goal of the project is developing a platform to test nanoparticles, building on Dr Laromaine's previous experience of developing 3-D cell scaffolds. Aerogels of biomaterials are being used to create biodegradable, transparent scaffolds which accurately mimic the biological environment; the material itself is porous, which Dr Laromaine says is an important issue. "Human tissues are porous, and they need sufficient nutrients, while cells have to be able to grow within the system," she says. A method called super-critical drying is used to remove liquid and maintain the material's porosity. "When you dry a porous material that has been submerged in water, the capillary forces actually make the pores close in the structure. By using super-critical drying, we prevent the pores in this structure from collapsing," continues Dr Laromaine.

Researchers are also working with another model system, *C. elegans*, which is also used to screen nanoparticles in the laboratory. These types of approaches are quicker and can be more efficient than existing methods of assessing nanoparticles, says Dr Laromaine. "This is much quicker than *in vivo* approaches. It's simpler experimentally, and you can still get very complex information," she explains. Researchers assess the viability and functionality of nanoparticles, aiming to evaluate how these nanoparticles change within a biological *in vivo* structure. "Are these nanoparticles the same status? Are they dispersed in a similar way to how they were first delivered? What is the coating of those nanoparticles? We approach these questions from the materials point of view," says Dr Laromaine.

The idea behind the project is that instead of evaluating nanoparticles on a 2-D cell culture, we will develop a 3-D cell culture and *in vivo* simple biological structures

These issues are critical to the application of nanoparticles in biomedicine. Researchers will assess the viability of Fe_xO_y nanoparticles which could be applied as magnetic labels of cells, a means of tracking the nanoparticle. "When the cells uptake those nanoparticles, you can then pinpoint where the cell is, and not only the nanoparticle. This is important, as you can then monitor the bio-distribution of those cells," outlines Dr Laromaine. More detailed characterisation of nanoparticles could open up new applications in biomedicine, but the immediate focus for the project will be on the platforms. "We aim to more fully validate the platforms and screen different types of nanoparticles, then we can look for more targeted applications. One could be developing iron oxide nanoparticles as a food supplement for anaemia for example," says Dr Laromaine.

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