

Nanotechnology Symposium

1-May-06 - 8:30 am - 10:15 am

Paul Sieving: So where do we stand? This slide is meant to give you a few chuckles. So far, nanotechnology is delivering self-cleaning windows. Well actually that does have some very practical play out for us because it would lead to self-sanitizing tiles in hospitals. I think we can see the value of organic light-emitting diodes. And those of you here who have a cup of coffee in your hands, I'd recommend spill resistant pants. And when you go outside, use your nanoparticle zinc oxide sunscreen. This is meant to be half facetious.

Here's my concept of nanodrug delivery – well, not really – but in fact this is a small, single, molecular car, the buckyball wheels are joined to the car body with axles that are chemical bonds and it's small. And the authors of this at Rice University, suggest that the bottom that this could be used to carry molecular cargo to microscopic construction sites. So let's stretch the idea and suggest that this could crawl along the vascular endothelium and deliver drugs to biological targets in the body.

Less facetiously and very real, self-assembling peptide nanofiber scaffolds. These were used to provide a bridge for tissue repair after axotomy. Cut the axon, provide these scaffolds, and the biological reparative processes of the body can use these to bridge the cut and repair the axon and in this case provide a return of vision.

This is something that interests me personally - I'm a biology guy- happen to have a degree in engineering. But I am fascinated by the power and the potential of biological structures to self assemble -- that's why we're all sitting in our chairs here today-- and to repair, so at what point should we really be considering proteins as nanomachines that are designed by nature for special tasks?

This is a paper that just came out in which blind mice, having lost their photo receptors, they were blind, were given the ability to react to light by making the ganglion cells photosensitive using a special protein nanomachine from green algae. This protein is a channel, and that channel is light sensitive so all of the complicated machinery that we mammals and primates pack into photoreceptors, with the rhodopsin, the transduction cascade, and the channel is packaged into one, single, nice, tight, protein nanomachine. When this is transfected into ganglion cells, provides ganglion cells the ability to respond directly to light. So I would say that the promises of nanotechnology need to be looked at in a broad context from physical objects all the way to proteins.

Just a few slides in conclusion. NIH is very interested in the potential of nanobiotechnology to impact health. This is packaged up at NIH in the initiative called the Nanomedicine Initiative it is one of the initiatives of the Roadmap. The concept of nanomedicine at this point is to develop concepts. It's to understand the interface between objects, physical objects, working at quantum levels, and biology. The goals would be to characterize the properties of molecules and nanomolecules or nanomachinery and cells, to understand the engineering principles that govern the interface between objects and biology and then to apply that as demonstration projects for repairing tissues and ultimately to prevent and cure disease.

We looked through the NEI database of funded applications and these are the current applications that seem to come closest two concepts of nanomedicines, nanobiotechnology, and nanotechnology. And as you can see this covers a broad

spectrum of concepts. So, for medicine nanotechnology is not simply a matter of making a small physical object, but in fact it's to understand how that object or how a specialized protein can be modified and used to interface with a cell for medical benefit.

And finally, "What is the Future of Nanomedicine and Vision Research?" Note that the title has a question because I don't have the answers and I don't think that we in the room yet have the answers. But areas that would appear to be ripe for application would be in drug delivery and DNA repair, retinal neuroprotheses, and all of the others of these. So if you have an interest in the biology of the eye and visual system and are working in any of these areas or any area and see a potential application for nanoconcepts--not nanotechnology--but nanoconcepts, nanoengineering, nanoprinciples, ultimately that would fit on the previous list of applications funded by NEI. Thank you.

Ritch: We'll take questions. We can barely see the microphones from here so just if you have a question come to the mike and call it out.

Sieving: Much better. I knew these ARVO hats were good for something.

Man: Somebody ask a question. Paul do you have any comments?

Sieving: Thank you, I appreciate the time.