

Chemical carriers

What are chemical carriers?

Scientists are creating chemical carriers that move throughout the body to deliver medicine to specific parts of the body. To do this, they are examining bacteria and natural chemicals to find out more about the way they travel and move. It is science at a very, very small scale – and because it takes place at the nanoscale it is known as nanoscience.

Nanoscience versus nanotechnology

We make a distinction between science and technology. We might refer to science as the study of how things work and what they are made of. We might then refer to technology as how we apply this knowledge to problems and create new machines and objects. For example, the Huygens probe that landed on Saturn's moon is an example of technology, while the data it collected is an example of science.

We also make a distinction between nanoscience and nanotechnology. Nanoscience is the study of how things work and what they are made of at the scale of 1 to 100 nm. A nanometre is 10^9 m wide. This is smaller than the human eye can see. A human hair is 80,000 nm wide! A strand of DNA is only 2 nm wide. Did you know your fingernails grow 1 nm per second? When we apply what we know about how things work at this small scale and create applications like the chemical carriers shown in the exhibition, this is an example of nanotechnology.

How do chemical carriers work?

The drugs are put in a package. This package is a two-layer container, called a vesicle, that the body allows to move around freely without rejecting it as a foreign object. The vesicle is not a miniature robot and is not able to move around the body on its own. Instead it is propelled around the body by a process called Brownian motion, where molecules inside the body hit the nanobot and propel it around. It eventually finds its way to the right spot in the body because of chemical signalling. The vesicle is attracted to the chemistry of the targeted area and continues to move towards it.

What are the advantages of this type of medication?

When drugs are targeted to a specific area in the body, they can be more effective, requiring less of the drug to be used. This can be less expensive, and also better for the patient. The patient may not face negative side effects in other parts of the body. The drug also can take action sooner.

What does all this have to do with Einstein?

Chemical carriers build on work completed by Einstein 100 years ago in 1905.

Over 75 years before Einstein a man named Robert Brown had noticed a strange phenomenon that he could not fully explain. He found that small particles suspended in liquid (for example, if tiny seeds were sitting in a glass of liquid) that they were moving a very small amount in a random way.

In 1905 Einstein predicted that the random movements of molecules in a liquid would make the same small particles move in the same random way. From the motion of the particles Einstein was to able to predict what the size of the molecules in the liquid were. The motion of the small particles is still called Brownian motion.

Where can I find out more?

http://www.nanotechinstitute.org/nti/drug_delivery.jsp