
Nanotechnology to nanomedicine: are we about to cross the blood brain barrier?

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Abstract

The brain is always confronted with the dilemma of the protection from noxious substances from the blood and the delivery of vital metabolites. Endothelial cells, forming together with other cells the blood-brain barrier (BBB), are known as the "gatekeepers" of this trafficking. On the one hand, the protection from toxic molecules is achieved by the obstruction of the paracellular pathway with tight junctions, that fuse brain capillary endothelia into a continuous tubular cell layer. On the other hand, vital molecules are transported from the blood by mean of active trans-cellular mechanisms. Many interests are focused on the BBB, with the aim to exploit these mechanisms for successful delivery of drugs across the barrier. About 98 per cent of today's medications cannot cross the blood-brain barrier in significant quantities. Drugs such as most antipsychotics, sleeping aids and antidepressants are smaller than 500 daltons and can sneak through. But they're in the two per cent of drugs that can get through. Some small, lipid-soluble drugs do cross the BBB simply by diffusion through the cell membrane, and others enter successfully via specialized transporter proteins. Many larger molecules, such as antibodies and enzymes, however, can't get through. Recently, the emerging field of nanotechnology has generated new promises to solve this problem. Which method is most successful will likely depend on what type of molecule you are going to target to the brain.

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