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# Nanoparticles for Brain Drug Delivery

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## Abstract (600)

The central nervous system, one of the most delicate microenvironments of the body, is protected by the blood-brain barrier (BBB) regulating its homeostasis. BBB is a highly complex structure that tightly regulates the movement of ions of a limited number of small molecules and of an even more restricted number of macromolecules from the blood to the brain, protecting it from injuries and diseases. However, the BBB also significantly precludes the delivery of drugs to the brain, thus, preventing the therapy of a number of neurological disorders. As a consequence, several strategies are currently being sought after to enhance the delivery of drugs across the BBB. Within this review, the recently born strategy of brain drug delivery based on the use of nanoparticles, multifunctional drug delivery systems with size in the order of one-billionth of meters, is described. The review also includes a brief description of the structural and physiological features of the barrier and of the most utilized nanoparticles for medical use. Finally, the potential neurotoxicity of nanoparticles is discussed, and future technological approaches are described. The strong efforts to allow the translation from preclinical to concrete clinical applications are worth the economic investments.

## Importance of research (200)

At the beginning of the third millennium, due to prolonged ageing, neurological disorders are growing, with a consequent high social impact due to their prevalence and/or high morbidity and mortality. For the purpose of calculation of estimates of the global burden of disease, the neurological disorders are included in two categories: neurological disorders within the neuropsychiatric category and neurological disorders from other categories. Neurological disorders within the neuropsychiatric category include epilepsy, Alzheimer and other dementias, Parkinson's disease, multiple sclerosis, and migraine. Neurological disorders from other categories include diseases and injuries which have neurological sequels such as cerebrovascular disease, neuroinfections, and neurological injuries.Neurological disorders are an important cause of mortality and constitute 12% of total deaths globally. Among the neurological disorders, Alzheimer and other dementias are estimated to constitute 2.84% of the total deaths, while cerebrovascular disease constitute about 8% of the total deaths in high income countries in 2005 Presently, there are no effective therapies for many of them. Scientific and technological researches, from molecular to behavioral levels, have been carried out in many directions but they have not yet been developed in a truly interdisciplinary way, and a definitive response is still far to be prospected. The immediate consequence of such condition is that several pathological disorders involving CNS remain untreatable. Examples of diseases include neurodegeneration (e.g., amyotrophic lateral sclerosis, Alzheimer's, Parkinson's, Huntington disease, and Prion Disease), genetic deficiencies (e.g., lysosomal storage diseases, leukodystrophy), and several types of brain cancer. Even if candidate drugs for therapy of such diseases may be already available in line of principle, they cannot be currently utilized because of their insignificant access to the central nervous system (CNS), due to the presence of the blood-brain barrier (BBB) preventing the passage from blood to the brain.

## Biography (200)

Robin Martinis full professor of Biochemistry and Molecular Biology at the School of Medicine, University Milano-Bicocca, Milano, Italy. He is Head of the Nanomedicine Center (NANOMIB) of the same University and Director of the International School of Nanomedicine at EMCSC (Erice, Italy). He has published more than 150 articles on the main Journals of Biochemistry, Neuroscience and Nanomedicine and is co-inventor of 2 families of patents concerning the use of nanoparticles for treatment of neurodegenerative diseases. MM coordinated the FP7 project "NAD, nanoparticles for therapy and diagnosis of Alzheimer Disease". MM is also CEO of AmypoPharma, a Spin-off Company of the University Milano-Bicocca aiming to carry nanoparticles for treatment of Alzheimer disease to the Clinical phase.

## About Institution(200)

The University of Milano-Bicocca (Italian: Università degli Studi di Milano-Bicocca, UNIMIB) is a public university located in Milan, Italy, providing undergraduate, graduate and post-graduate education. Established in 1998, it was ranked by the Times Higher Education 2014 ranking of the best 100 Universities under 50 years old as number 21 worldwide and first in Italy.

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