Vladimir Torchilin, J Pharm Drug Deliv Res 2017, 6:3 (Suppl)
http://dx.doi.org/10.4172/2325-9604.C1.016

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What properties should nano preparations possess to become effective anticancer medicines?

Tumor therapy, especially in the case of multidrug resistant cancers, could be significantly enhanced by using siRNA down-regulating the production of proteins, which are involved in cancer cell resistance, such as Pgp or survivin. Even better response could be achieved such as siRNA could be delivered to tumors together with chemotherapeutic agent. This task is complicated by low stability of siRNA in biological surrounding. Thus, the delivery system should simultaneously protect siRNA from degradation. Additionally, these nano preparations can be loaded into their lipidic core with poorly water soluble chemotherapeutic agents, such as paclitaxel or camptothecin. In experiments with cancer cell monolayers, cancer cell 3D spheroids, and in animals with implanted tumors, it was shown that such co-loaded preparations can significantly down-regulate target proteins in cancer cells, enhance drug activity, and reverse multidrug resistance. In order to specifically unload such nano preparations inside tumors, we made them sensitive to local tumor-specific stimuli, such as lowered pH, hypoxia, or overexpressed certain enzymes, such as matrix metalloproteases. Using pH-, hypoxia-, or MMP2-sensitive bonds between different components of nano preparations co-loaded with siRNA and drugs, we were able to make the systems specifically delivering biologically active agents in tumors, which resulted in significantly improved therapeutic response.

Biography

Vladimir Torchilin is a university distinguished Professor and Director at Northeastern University, Center for Pharmaceutical Biotechnology and Nano-medicine, Boston. He completed his Graduation and MS in Chemistry at Moscow University. He completed his PhD and DSc in Polymer Chemistry and Chemistry of Physiologically Active Compounds in 1971 and 1980, respectively. In 1991, he joined MGH/Harvard Medical School as Head of Chemistry Program, Center for Imaging and Pharmaceutical Research, and Associate Professor of Radiology. He was the Chair in Department of Pharmaceutical Sciences from 1998-2008. His research interests include "liposomes, lipid-core micelles, biomedical polymers, drug delivery and targeting, pharmaceutical nano carriers and experimental cancer immunology". He has published more than 350 original papers (which received more than 30,000 citations), more than 150 reviews and book chapters.

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