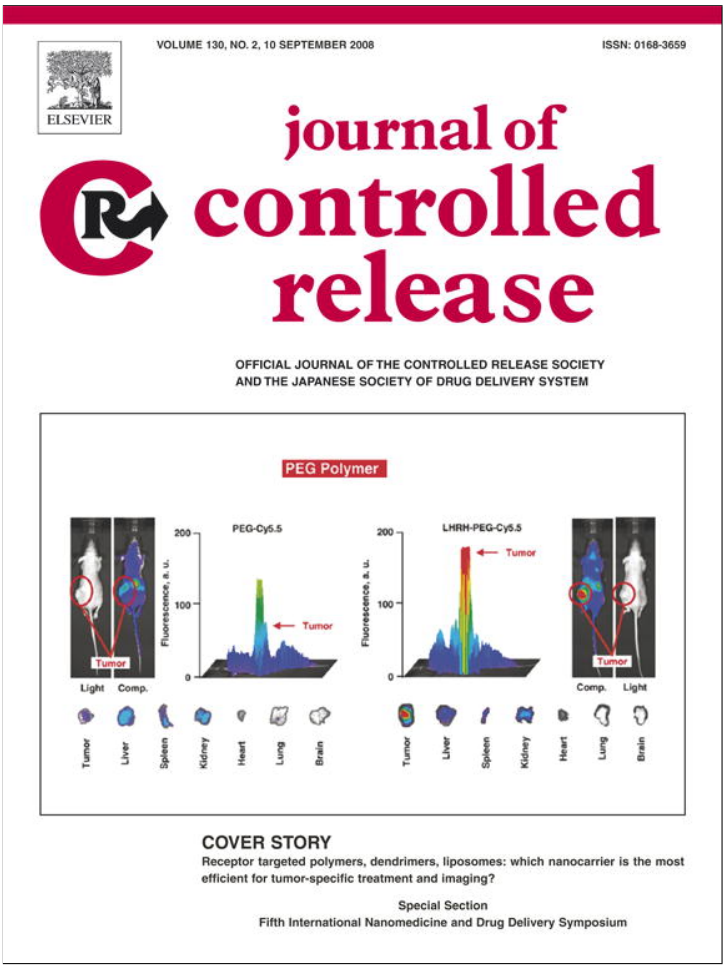

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Cover Story

All nanocarriers are created equal

Many types of nanocarriers are currently being used to deliver various types of anticancer agents including drugs, proteins/peptides, oligonucleotides, siRNA, and DNA. These nanocarriers vary in molecular mass, size, architecture, and electrical charge. Thus, they have different cell penetrating ability, pharmacokinetics, and organ distribution, resulting in modulation of the efficacy of the delivered drug. Targeting of nanocarriers to tumors has been one of the holy grails of drug delivery. Drug carriers with the targeting property provide several advantages over non-targeted carriers. First, tumor targeting enhances the accumulation of a carrier and delivered active components in tumor limiting adverse side effects of chemotherapy on healthy organs. Secondly, targeting of nanocarriers to receptors overexpressed on the plasma membrane of cancer cells changes the mechanism of their cellular internalization from relatively inefficient "simple" diffusion and endocytosis to effective receptor-mediated endocytosis. Such a shift enhances the specific efficacy of the carrier payload. Studying different nanocarriers in her laboratory, Professor Tamara Minko and colleagues raised two important questions. First, which type of tumor-targeted nanocarriers is most suitable for tumor treatment and imaging? Second, how tumor targeting influences on distribution and cytotoxicity of drug(s) delivered by different nanocarriers? To answer these questions they synthesized three types of tumor-targeted nanocarriers: linear polymers, branched dendrimers, and liposomes. Carriers were loaded with infrared cyanine Cy5.5 dye (an imaging agent) and/or paclitaxel (an anticancer drug with poor aqueous solubility). Tumor targeting was provided by a synthetic analog of luteinizing hormone-releasing hormone (LHRH). Selected nanocarriers were examined *in vitro* and *in vivo*. The results of this study are published in this issue [1].

As expected, cancer cell-specific targeting enhanced tumor accumulation and effectiveness of the delivered anticancer drug and minimized its adverse side effects on healthy tissues. In addition, the authors discovered an interesting and practically important phenomenon. Targeting of nanocarriers to tumors minimized the influence of the architecture, composition, size and molecular mass of nanocarriers on the efficacy of imaging and cancer treatment. Consequently, drugs delivered by different nanocarriers will possess a comparable anticancer efficacy after their targeting to tumor cells. This finding can potentially produce a high impact on nanocarrier-based drug delivery of cancer therapeutics. This study implies that one can design a nanocarrier architecture with specific composition, size, molecular mass and other characteristics based solely on the effective encapsulation of anticancer drug, desired drug release profile, intracellular distribution, cost, and other factors. While more studies with a wide variety of nanocarriers will be necessary to see whether the observation by Professor Minko is general or not, it certainly provides a new avenue for design of nanocarriers for cancer treatment and imaging.

Reference

[1] M. Saad, O.B. Garbuzenko, E. Ber, P. Chandna, J.J. Khandare, V.P. Pozharov, T. Minko, Receptor targeted polymers, dendrimers, liposomes: which nanocarrier is the most efficient for tumor-specific treatment and imaging? J. Control. Release 130 (2008) 107–114, doi:10.1016/j.jconrel.2008.05.024.

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