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Letter to Editor

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# Self-assembly Delivery Targets in Pharmaceutical Industry

**Hajar Nili Ahmadabadi[1], Sahin Uyaver[2*]**

[1]Department of Physics, Alzahra University, Tehran 1993891167, Iran
[2]Department of Energy Science and Technologies, Turkish-German University, 34820 Istanbul, Turkey

***Corresponding author:** Sahin Uyaver, Fax: 90 216 333 30 38, Tel: 90 216 333 33 12, Email: uyaver@tau.edu.tr

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## Dear Editor

A number of studies have recently been conducted in the pharmaceutical industry to discover new methods for curing specific diseases, chronic ailments, and genetic disorders. Among these new methods, the use of delivery vesicles has the most therapeutic effect and will improve drug efficiency and patient compliance (1). To design such delivery systems, macromolecular self-assembled structures should be exploited to engineer self-assembled materials for encapsulation to release at the target tissue. The production of such materials is based on the self-assembling technique, and the elements of the system get automatically together and form well-defined stable structures under a thermodynamically equilibrated state. Different kinds of interactions such as electrostatic and hydrophobic interactions, hydrogen bonding, π-π stacking, and other interactions ensure the structure that molecules are wired at a stable low level of energy (2). A variety of such macromolecular self-assembled materials have been generated through the years and tested successfully, and are recently common in therapeutic procedures (3). This success can be accounted as a highlighted pattern for a successful combination between physics and biology. Self-assembled materials, the creation of which roots in soft matter physics, could replace invasive surgical procedures by localized treatments. The main reason for forming such self-assembled materials is non-covalent, weak interactions, which form among the monomers to push the monomers for automatic assembly. The research in this realm shows that micelles and vesicles from lipids and polymers are most prevalent for drug-delivery systems (3). However, other applicable structures are reported, including tubules, fibrils, or other complex systems such as molecular hydrogels for this purpose (4). The control parameters of final assembled systems return to the structure of monomers and the external condition, leading to the occurrence of self-assembly in that environment. The temperature, pH, ionic strength of the solution, and concentration of the system are among the parameters that force the monomers to form one specific structure. Among these parameters, concentration is more easily tractable to find whether a structure is formed or not. Critical micelle concentration and temperature are the signs below of which, there are separate monomers while the self-assemble structure begins to form at and above them (5). Some reports show extensive benefits of these drug-delivery vehicles as pharmaceutical agents. For instance, they are widely used in the treatment of cancer, small hydrophobic drugs (paclitaxel) (6), and for female birth control (levonorgestrel) (7) and pain killer or anti-inflammatory care (morphine) (8). Moreover, the results demonstrate that diabetic drugs (9) and chronic hormone treatments (10) take advantage of some protein- and peptide-based products and can efficiently deliver the containers to the target tissue. The present and future challenges in this realm are more focused on improving stability and optimizing performance in order to provide effective treatments and patient compliance. This will not happen unless physicists and biologists can further cooperate more systematically.

## Conflict of Interests

The authors report no conflict of interests.

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