Biological responses to encapsulating layers and cellular activities in a co-culture system of T cells encapsulated with PSS-coated gold nanorods

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Encapsulation of single cells is receiving increasing attention because there is a high possibility to use this technique in various biomedical and biological applications1. In the meantime, T cell-based therapy has been found to provide a high potential for cancer treatment and immunotherapeutic treatments2,3,4. However, it was reported that T cells could interact with cells in the immune system of recipient during cell transplantation resulting in an occurrence of some negative effects5. Due to this reason, T cells are one type of cells that are attractive to be combined with cell encapsulation technique for therapeutic purpose to avoid the problem of negative effect induction. Here, we demonstrate the new approach by using polystyrene sulfonate coated-gold nanorods (PSS-GNRs) to be an outer layer on the cell surface. We used Jurkat T cells as a model cell in our study. Jurkat T cells were encapsulated with poly(allyamine hydrochloride) (PAH) and/or PSS-GNRs or polystyrene sulfonate (PSS). The investigation of biological activities of T cells encapsulated with polyelectrolytes and gold nanorods was performed. The results showed that T cells encapsulated with PSS-GNRs, PAH and PSS, or PAH alone could survive and proliferate. In the case of a co-culture system, when encapsulated Jurkat T cells were co-cultured with THP-1 macrophages, the co-cultures exhibited TNF-α production enhancement. However, the TNF-α production enhancement was not found when THP-1 macrophages were co-cultured with PSS-GNR/PAH@Jurkat or PSS/PAH@Jurkat. This indicates that the encapsulating layer could help avoid the interaction between THP-1 macrophages and Jurkat T cells that related to TNF-α induction. As well, no significant inductions of IL-2, IL-1β, and IL-6 were detected in a co-culture system5. The layer of PSS-GNRs at the surface of cells should also provide a benefit in increasing the efficiency for diagnostic or therapeutic purposes due to the unique property of GNRs. With the positive outcome of biological activity assessment, the data here provide promising results of the possibility of using encapsulated PSS-GNR/PAH@Jurkat for immunotherapy application and other biomedical applications in the future.

References
4- S. Zhao et al., ACS Nano 10, 6189 (2016).