Recapping 2020’s Top Nanotechnologies for Life: Synergistic Combination of Calcium and Citrate in Mesoporous Nanoparticles Targets Pleural Tumors

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A colloidal composition of nanoparticles containing calcium phosphate and citrate covered by lipid layer has been successfully developed to overcome previous cancer treatments’ unwanted toxicity and increase method selectivity utilizing engineered mechanisms in cell death procedure.

Cancer therapeutic approaches are mostly along with undesirable cell toxicity as a result of the low selectivity of medications affection mechanisms leading to unprofitable cell annihilation and inefficient disease treatment. To discuss a solution, calcium phosphate and citrate which are completely non-toxic to healthy cells, appear to be highly toxic to cancerous ones due to an unknown mechanism taking place inside cells after chemicals transmitting the membrane.

Following the pharmaceutical development route, the next challenge would be mentioned chemical passage through the membrane in needed fetal doses. In fact, calcium phosphate and citrate are both involved in cell signaling procedure but cells are automatically controlling their amount in the cytoplasm to restrain possible disruption caused by high doses; therefore, engineered modifications are actually required to overcome discussed barrier.

According to the explained background, Dr. Constantin von Schirnding, Dr. Hanna Engelke, and Prof. Thomas Bein in LUM Munich University together have been dealing with this problem which results in the development of colloidal amorphous and mesoporous nanoparticles component including calcium phosphate and citrate (CPCs) and ultimately a lipid layer covering the system enabling the high doses of these particles passing through the cell membrane in the absence of the cell automatic composition analysis (the relevant paper is available in Chem Journal).

The remarkable aspect of such a solution can be enumerated as the material ability to pass cell membrane and consequently the lipid layer rupture inside engaged cells resulting in chemical release in an unidentified mechanism leading to cell death. Simultaneously, the noted component is absolutely non-toxic before endosomal release and after degradation to be finally excreted from cells without any extra reaction.

This medication indicated a 70% and 40% reduction of pleural cancer tumor size of mice for two different doses. It should be pointed that the targeted tumor here mostly shows metastasis behavior and growth locally in between ribcage and lung which is not directly in contact with blood circulation.

Hence, this part won't be efficiently responding to chemotherapy, while the discussed method can successfully assess the missed space and affect local cancerous cells. In-vivo experiments demonstrate high selectivity and no toxicity for cases under consideration in two months.

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