Graphene Sheets as Drug Delivery Vehicles into Cancer Cells

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Although conventional chemotherapy has displayed notable efficacy in destroying cancerous cells, this non-specific treatment also tends to harm surrounding healthy cells. To counteract this non-specificity, patients are often treated with higher concentrations of chemotherapeutic drugs, producing a plethora of inconvenient side effects and potentially leading to chemoresistance. The rise of nanotechnology has provided an opportunity to reshape current drug delivery strategies to cancerous cells. Graphene sheets manifest multiple properties unique to its 2D structure including positive adherence to functionalization and great potential as a drug-loading platform. This study analyzed the cytotoxic effects of delivering gambogic acid via graphene sheets to breast and prostate cancer cell lines. Gambogic acid, selected for its notable anti-cancer activity, was adhered to the surface of graphene sheets and delivered to both cell types. It was hypothesized that employing graphene sheets as a drug delivery vehicle for gambogic acid would enhance the anti-cancer activity of the drug. Various treatment conditions were used to study the individual and combined cytotoxic effects of each agent. The results of the study suggest that delivering gambogic acid via graphene sheets enhances the cytotoxic effects of the drug; the amount of cancerous cells killed following treatment with the drug-nanomaterial synthesis was greater than the amount destroyed by gambogic acid alone. With additional improvements, this approach to drug delivery could potentially reform current chemotherapeutic strategies.