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| **Safety Optimisation of a hybrid nanoparticle based on thermo-responsive delivery system for pancreatic cancer treatment.** |
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| **Background:** Pancreatic cancer is a very aggressive form of cancer, accounting for 7% of all cancer deaths. It is the eighth most common cancer in women and tenth most common cancer in men. The incidence rates of pancreatic cancer have gone up by around 1% each year since 2000. An estimated 495,773 people worldwide were diagnosed with pancreatic cancer in 2020 [1]. The lack of symptoms results in a delayed diagnosis and therefore, a delay in the treatment of cancer. Current therapies for pancreatic cancer include fluorouracil, gemcitabine and paclitaxel. Nanotechnology offers the benefit of enhancing drug delivery to the targeted tissue because of increased drug permeability. This also reduces side effects and sustains drug release over a long period of time [2]. The focus for this project is to safely optimise a hybrid nanoparticle for pancreatic cancer treatment. Therefore, a range of assays will be performed to assess cytotoxicity of the nanoparticles.  [1] Cancer.Net, 2022. Pancreatic cancer- statistics. Available at: <https://www.cancer.net/cancer-types/pancreatic-cancer/statistics> (Accessed April 13, 2023).  [2] Kadam, R., Bourne, D. and Kompella, U., 2012. Nano-Advantage in Enhanced Drug Delivery with Biodegradable Nanoparticles: Contribution of Reduced Clearance. Drug Metabolism and Disposition, 40(7), pp.1380-1388. |
| **Methods:** The synthesized nanoparticles will be fully characterized using different techniques. *In vitro* effects on cell response will be monitored in several assays to test for cytotoxicity of the nanoparticles in the cells, cell membrane integrity and production of reactive oxygen species in pancreatic cell lines. Hybrid nanoparticles will be surface engineered to protect the drug molecules from metabolism until they are heated and drug release occurs. The hybrid nanoparticles will be protected with a novel thermoresponsive polymer. |
| **Results:** The synthesized nanoparticles, including the gold- iron oxide hybrid nanoparticles (AuHNPs) have been fully characterized using various techniques including transmission electron microscopy (TEM) and dynamic light scattering (DLS). The particle size was determined to be around 100nm, with a gold: iron ratio of 3:1. The particles have been incubated in BxPC-3 cells. This has proven biocompatibility of AuHNPs and iron oxide nanoparticles, although this is still under investigation as there could be interference with the MTT assay. Cell counting using Trypan blue exclusion assay and cellular uptake analysis of these nanoparticles in the cells has been done. Preliminary data suggests that addition of a polymer to the nanoparticles further protects cells from toxicity and will be further investigated. |
| **Conclusions**: Toxicity evaluation of newly developed nanoparticles must be considered in the future design of safe agents for cancer applications. More research is needed on nanotoxicity and is currently ongoing in the lab. |