Combined Artificial Intelligence and Nano-cell Internalization to Predict Cancer Aggressiveness

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Cancer is a leading cause of death worldwide. After the cancer diagnosis, the oncologist will stage cancer and devise an effective treatment plan. Novel methods to predict the severity is a significant clinical need, given cancer's complexity. I combine nanotechnology and artificial intelligence to address this problem. I hypothesized that the aggressive nature of cancer can be predicted using the cell's ability to internalize functionalized nanoparticles. The internalization of nanoparticles within cancer cells is driven by one of the four primary mechanisms. Using molecules that can inhibit these cellular pathways for internalization, one can deduce the mechanism of internalization. The severity of cancer can be predicted based on the nature of internalization, as the degree and means of internalization serve as an 'identifier' for the cell. However, the process is complicated due to the sheer data required with the use of multiple nanoparticles in different cells and inhibitors. Therefore, the data analysis requires a machine learning (ML) model that can be trained as more data is generated. To address this, I trained a neural network using available data on carbon nanoparticles' internalization in cell lines. To test the ML model, I designed non-targeted and receptor-targeted nanoparticles to predict cancer severity. The non-targeted nanoparticle, which utilizes one of the four different mechanisms, predicts the severity accurately. Using five different cancer cells and four inhibitors, the ML model with non-targeted nanoparticles predicts the cancer severity with >95% accuracy. Prior to clinical translation, the model should be validated in additional cell lines.

Awards Won: