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Combination therapy in combat with cancer

Cancer, in its myriad of manifestations, remains among the leading causes of death – notwithstanding a remarkable surge in the medical field to alleviate cancer-related mortality. The development of treatment methods with higher efficacy is therefore of paramount importance. It was the objective of this thesis work to examine the combination of *radiotherapy* (such as X-rays) and *immunotherapy* (medicinal drugs) in cancer treatment.

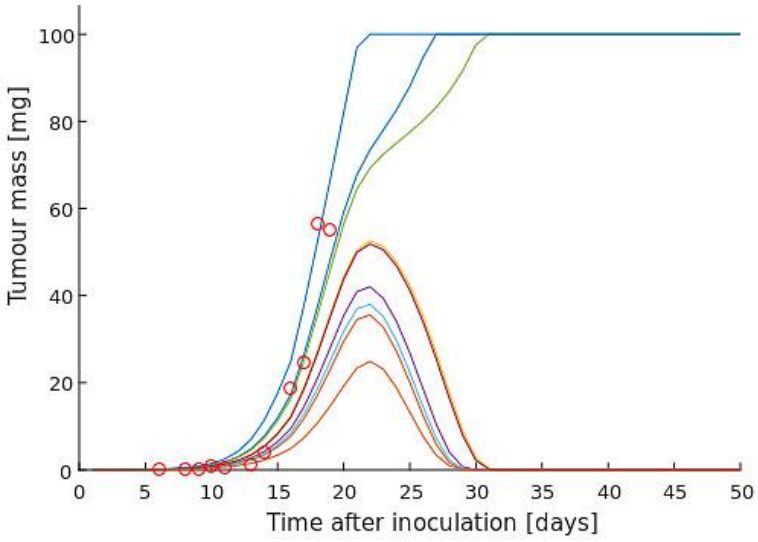
All living organisms consist of cells that divide and multiply so that the organisms grow. When cell division happens in an unnaturally rapid and uncontrolled manner (possibly due to some genetic modification in the cells), cancer has established itself. Normally, the body's defense system – the immune system – can identify and attack harmful agents because they release *antigens* (substances which alert the immune system of an intrusion). What makes cancer pernicious is its ability to escape detection by, and suppress, the immune system. The body fails to fight cancer because it does not recognize it as a disease. A particularly dreadful cancer variety is *glioblastoma* – the most prevalent and malignant of all brain cancers in adults. Conventional cancer therapies – radiotherapy, surgery, chemotherapy and their combinations – fail to cure this cancer.

This work explored a novel treatment combining radiotherapy and immunotherapy as glioblastoma treatment. Immunotherapy was given in the form of the drug 1-methyltryptophan (1-MT). The study's foundation was the finding that radiation can force cancer cells to release antigens and thus be detected by the immune system. Immunotherapy then motivates the immune system to attack and eliminate the cancer cells. The study was done using mathematical models from Serre et al. (Serre model) and Wilkie and Hahnfeldt (Wilkie model) as bases for computer simulations of cancer in rats.

Major findings

Both the Wilkie and Serre models confirmed a synergy between radiotherapy and immunotherapy and that the success of this treatment method depends on how the radiation is given (dose scheduling). The Serre model further provided that the highest survival would be obtained if two moderate doses of radiation were delivered no more than a week apart, alongside 1-MT treatment.

The figure to the right shows the development of the tumours in nine rats for the highest-survival case. Each curve represents a tumour in a rat and the red dots show the growth of an untreated tumour. Most of the tumours are eliminated (their masses go to zero during treatment), indicating curative treatment. If confirmed by experiment or clinical trials, the results of this work may have important implications for the future of cancer therapy and research in the field.



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