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Combination therapies and drug resistance in heterogeneous tumoral populations

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How combination therapies can reduce the emergence of cancer drug resistance? Can we exploit intra-tumoral competition to modify the effectiveness of anti-cancer treatments?

Bearing these questions in mind, we present a mathematical model of cancer-immune competition under therapies. The model consists of a system of differential equations for the dynamics of two cancer clones and T-cells. Comparisons with experimental data and clinical protocols have been performed.

In silico experiments confirm that the selection of proper infusion schedules plays a key role in the success of anti-cancer therapies. The outcomes of protocols of chemotherapy and immunotherapy (separately and in combination) differing in doses and timing of the treatments are analyzed.

In particular, we highlight how exploiting the competition between cancer populations seems to be an effective recipe to limit the insurgence of resistant populations. In some cases, combination of low doses therapies could yield a substantial control of the total tumor population without imposing a massive selective pressure that would suppress the sensitive clones leaving unchecked the clonal types resistant to therapies.

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