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CANCER IMMUNOPREVENTION: WHAT CAN WE LEARN FROM IN SILICO MODELS?*

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This paper reviews the results of a model on the artificial immunity induced by an immunoprevention vaccine for mammary carcinoma successfully tested on transgenic HER-2/neu mice.

The goal of this study is to find a model based approach to determine a vaccination schedule using in silico experiments.

The model mimics the phenomenon of initial cancer growing starting from the stage of the atypical hyperplasia and reproduces the action of the vaccine in activating the immune response. The model has been validated against in vivo experiments.

Even if the model contains many biological details, the effect of vaccinations in controlling the tumor growth can be summarized using the time evolution of three quantities: the number of cancer cells, the number of cytotoxic T-cells and the number of antibodies. Using these quantities as coordinates of the state-space of the system we can analyze the vaccine’s action using the trajectories described by the system in this space.

A vaccination schedule is an effective one if it prevents the solid-tumor formation. An optimal vaccination schedule is an effective schedule with the minimum number of vaccine administration.

A systematic search for an optimal schedule is almost impossible with in vivo experiments as it would be too expensive.

We show how the model can be used to suggest optimal vaccination schedules which can be tested in vivo. Replacing in vivo experiments with model’s simulations we can search a optimum for the schedule using a genetic algorithm based strategy. The vaccination schedule proposed using the model is substantially lighter than the one’s determined by the standard intuitive procedure.

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