New mathematical model shows promising results for prostate cancer treatment

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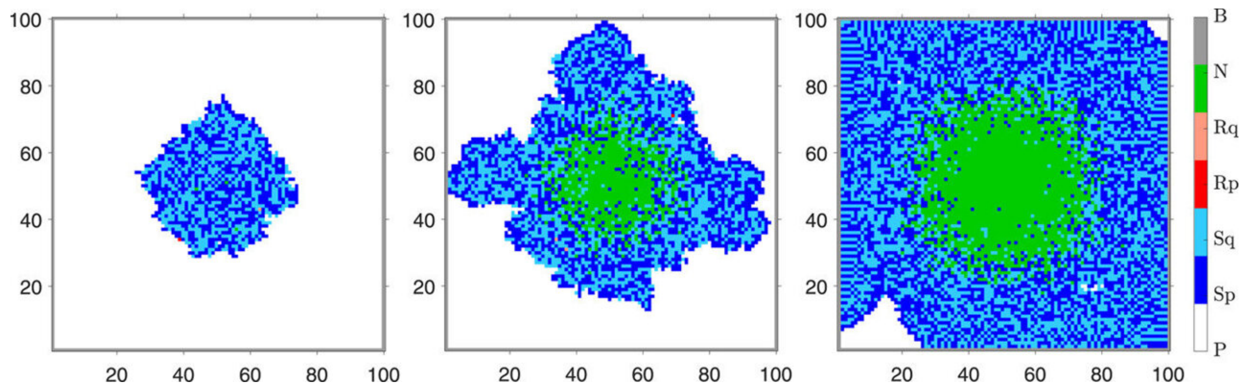

Graphical abstract. Credit: *Mathematical Biosciences* (2022). DOI: 10.1016/j.mbs.2022.108940

A new mathematical model which aims to optimize treatment for prostate cancer has been developed by experts at the University of Portsmouth.

Prostate cancer is the second most common cancer among men worldwide and accounts for 26 percent of all new cancer cases in males in the UK.

Over the past few decades mathematical models of tumor growth have been used to better understand the disease, to make predictions and to guide new experiments and clinical trials.

Dr. Marianna Cerasuolo, Senior Lecturer from the University's School of Mathematics and Physics, has worked on prostate cancer research since 2014, designing the best therapeutic strategies to eliminate tumors.

Her latest study considers the effects of multiple drug therapies by formulating a model that doesn't just represent the growth of cancer cells in time, but also the growth of cells in space.

Dr. Cerasuolo worked on the research with Dr. Andrew Burbanks from the University of Portsmouth, and Professor Roberto Ronca from the University of Brescia, Italy.

She said, "With more than 11,500 men dying from prostate cancer every year, research into the causes, and potential therapies, remains critical."

"Our recent research looked at a slice of prostate, as through a microscope, and then computationally observed how the growth of cancer cells is affected when you add certain drugs. Using a spatial distribution of cancer cells and analyzing certain combinations of drugs, we found that some treatments would get rid of the cancer completely in the model."

The therapeutic strategies explored by Dr. Cerasuolo and her colleagues include the use of a single drug, enzalutamide, and drug combinations, such as enzalutamide and everolimus or cabazitaxel, with different treatment schedules.

The results of the study show that alternating therapies—specifically the combination of two drugs, enzalutamide and cabazitaxel—could significantly improve cancer treatment. This was verified by comparing the results with data obtained from mice with cancer.

Dr. Cerasuolo said, "We're confident that our mathematical simulations are reasonable predictions of a tumor's behavior in the short and long term."

"However, this mathematical model is based on cancer in mice and further work would be needed to obtain a mathematical modeling framework able to support research in humans and clinical trials."

The paper is published in the journal *Mathematical Biosciences.*

More information: Andrew Burbanks et al, A hybrid spatiotemporal model of PCa dynamics and insights into optimal therapeutic strategies, *Mathematical Biosciences* (2022). DOI: 10.1016/j.mbs.2022.108940

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