

## A new model for spheroid growth

*Sunday, 10 October 2021 16:10 (20 minutes)*

Spheroids are a model commonly used in research into new cancer treatments and therapies. They mimic the structure, microenvironment and cells signaling present in solid tumors [1]. The following features can be recalled, that makes spheroids a perfect model for investigations into cancer treatment, like their layered composition, forced by the availability of nutrients, the growth kinetics and the expression pattern of some genes similar in spheroids and tumors [2,3]. In particular, three types of cells in the spheroid, as well as in tumors, can be distinguished, which maintain their layered architecture: dead cells inside the spheroid (necrotic zone); living, non-proliferating cells in the middle (quiescent zone); and living and proliferating cells in the outer layer of the spheroid [4,5]. We propose a new spheroid growth model which reveals the growth dynamics of three spheroid zones. The model assumes different probabilities of the cell transition from proliferating to non-proliferating cells and from non-proliferating to necrotic ones. This biological process goes only in one direction. We present a theoretical model based on simulations and experimental data. By the presented model, it is possible to assess proliferative and non proliferating cells, which may be helpful in an experiment planning, when particular fraction of proliferating cells are needed. In addition, the simulation data allow not only to confirm the prediction from the model used, but also to check how cells in a given state are distributed inside the spheroids. In particular, the model allows an additional estimation of the fraction of dead cells indirectly, only from the growth curve. Therefore, the presented model can potentially provide more information than the standard approach in such studies of the growth dynamics of tumors – the Gompertz curve.

### References:

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### Acknowledgments:

This work was supported by the Foundation for Polish Science through the TEAM POIR.04.04.00-00-4204/17 Programme and the SciMat Priority Research Area budget under the Strategic Programme Excellence Initiative at the Jagiellonian University through grant No. U1U/P05/NW/03.23.

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**Session Classification:** Poster Session