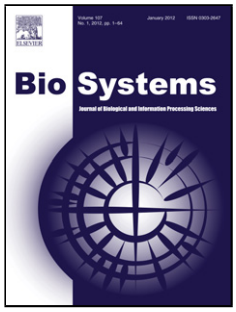

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Metabolism is the Tie: The Bertalanffy-type Cancer Growth Model as Common Denominator of Various Modelling Approaches

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Abstract

Cancer or tumour growth has been addressed from a variety of mathematical modelling perspectives in the past. Examples are single variable growth models, reaction diffusion models, compartment models, individual cell-based models, clonal competition models, to name only a few. In this paper, we show that the so called Bertalanffy-type growth model is a macroscopic model variant that can be conceived as an optimal condensed modelling approach that to a high degree preserves complexity with respect to the aforementioned more complex modelling variants. The derivation of the Bertalanffy-type model is crucially based on features of metabolism. Therefore, this model contains a shape parameter that can be interpreted as a resource utilisation efficiency. This shape parameter reflects features that are usually captured in much more complex models. To be specific, the shape parameter is related to morphological structures of tumours, which in turn depend on metabolic conditions.

We, furthermore, show that a single variable variant of the Bertalanffy-type model can straightforwardly be extended to a multiclonal competition model. Since competition is crucially based on available shared or clone-specific resources, the metabolism-based approach is an obvious candidate to capture clonal competition. Depending on the specific context, metabolic reprogramming or other oncogene driven changes either lead to a suppres-

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