

# Mathematical Modelling and Personalized Simulations of Erythropoiesis in the Context of Polycythemia Vera

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**Abstract:** The disease Polycythemia Vera (PV) is a form of blood cancer which results in an uncontrolled blood cell production, especially of red blood cells (RBC). In early stages of the disease patients are treated with phlebotomy in certain intervals. The timing of the phlebotomy is based on the personal experience of the attending physician and on additional information about the individual production rate of RBC from weekly clinical measurements. From clinical practice it is known that the proposed phlebotomy timing is not always properly chosen due to the uncertain growth rate of RBC in PV patients. A solution to this problem could be a suitable mathematical model of erythropoiesis, where desired properties can be fit to the individual patient by using clinical data.

Several mathematical models describing erythropoiesis on a cellular level were developed in the last years. We discuss their advantages and disadvantages from a practical point of view, with the long term vision of a model based decision support tool for clinical practice. This point of view comprehends issues like identifiability of parameters, possible extensions that are specific for PV patients, numerical behavior in the context of parameter estimation and experimental design, and model complexity. We illustrate our conclusions with numerical results.

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