**Dedicated to the memory of Andrei Yu. Yakovlev**

# Branching Processes in Cell Proliferation Kinetics

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**Abstract**

Some basic models and characteristics of cell proliferation kinetics using branching processes are considered in [1-4]. An important problem is the distribution of the discrete marks (labels) obtained in [3] and [4] using a model with infinite many types of Bellman-Harris branching processes. Generalizations in the case of continuous labels are given in [6] and [8]. Note that processes with continuous labels are first considered by Kolmogorov. New models of renewing cell populations (*in vivo*) using age-dependent branching processes with non-homogeneous Poisson immigration are proposed in [7]. Leukemia cell kinetics with a stem cell immigration component is studied in [5]. Multitype age-dependent branching processes with randomly chosen paths of evolution are proposed in [10] as models of progenitor cell populations (*in vitro*) with estimating of the offspring distributions using real data as well as bootstrap methods. An interesting and important problem arising from cell proliferation kinetics is the definition and the limiting behaviour of age and residual lifetime distributions for branching processes considered in [9].

The relative frequencies of distinct types of cells in multitype branching processes with a large number of ancestors are investigated in [11] and [12]. The reported limiting results are of advantage in cell kinetics studies where the relative frequencies but not the absolute cell counts are accessible to measurement. In [11] some relevant statistical applications are discussed in the context of asymptotic maximum likelihood inference for multitype branching processes. In [12] the asymptotic behavior of multitype Markov branching processes with discrete or continuous time is investigated in the positive regular and nonsingular case when both the initial number of ancestors and the time tend to infinity. Some limiting distributions are obtained as well as multivariate asymptotic normality is proved. The results from [11] and [12] have a specific applications in cell proliferation kinetics.

Finally it is worth to point out that new problems in the theory of branching processes appeared as a result of cell proliferation modeling and the talk will be focused on some of these new ideas.

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