Fima Klebaner, Monash University

What can be observed in real time PCR and when does it show?

Abstract

We present a mathematical model of the Polymerase Chain Reaction (PCR) as a density binary splitting. This model is based on Michaelis-Menten kinetics, which states that a molecule replicates with a probability $p(z)$, whichis of the form $p(z) = \frac{vK}{K+z}$, where z is the number of molecules and K is the Michaelis-Menten constant, assumed to be large. Real time, or quantitative, PCR typically starts from a very low concentration of initial DNA strands. This model predicts that it is impossible to observe the initial number doing only a fixed number of replications, but is possible when the number of iteration is proportional to $\log K$. This theoretical result seems to be in agreement with empirical observations. Mathematically, this phenomenon is described by a fluid limit with a random initial condition (continuous time is in JAP 53(2016) Barbour, Chigansky and Klebaner). This is joint work with Peter Jagers (Chalmers Uni) and Pavel Chigansky (Hebrew Uni).