

Tandem DNA repeats: Propagation in the microgene polymerization reaction

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In the Microgene Polymerization Reaction (MPR), a short non-repetitive homo-duplex DNA propagates exponentially to multiple repetitive products during Polymerase Chain Reaction cycles in a mechanism that involves staggered annealing of complementary DNA strands of variable lengths and polymerase-mediated filling-in of the generated overhangs. The MPR was dissected to sub-reactions, the thermodynamics and kinetics of which were formulated, tested experimentally and analyzed; it seems to share common features with chain- and step-growth polymerization types. The MPR is kinetically divided into 3 stages: *initiation*, *amplification* and *propagation*, each is subdivided into a number of steps. Propagation, the autocatalytic process resulting in an exponential growth of the number of repeats per polymer molecule, is initiated by generation of initial doublet (ID), the minimal repetitive unit that is inclined to expand by staggered re-annealing and replication of overhangs, and is terminated when nucleotides are depleted. The molecularity of 3.1 estimated for the initiation process leads to a simple mechanism: 3 original singlets (single-stranded constituent of the duplex) interact by rare and reversible association to form an ID through a nucleation complex; one singlet aligns and bridges the other two, fixing them unstably in the required proximity for the DNA polymerase to skip the inter-template gap. Results clearly indicate existence of an amplification stage, and the proposed models, thermodynamic for initiation and kinetic for propagation, agree well with experimental results (e.g., Itsko *et al.*, *Biophys J* 96:1866, 2009). The model quantitatively explains the MPR propagation and be used as a good approximation for this phenomenon.

Biography

Arieh Zaritsky has completed his Ph.D. in Leicester University (UK, 1971) and postdoctoral studies in Copenhagen University-Institute of Microbiology (DK). He was the Chairman elect of Ben-Gurion University's Life Sciences Department (1989-91). During his 45-years career, he has published over 120 articles and reviewed many manuscripts in Peer-reviewed, reputed periodicals, visited the following Universities: Amsterdam (NL), Yale, Berkeley, Arizona, Florida, Harvard (USA), Wuhan (PRC) and Griffith (Australia), awarded numerous, highly competitive Research Grants and personal Fellowships (from e.g., Burrough- Wellcome, EMBO, UNESCO, WHO, US-AID, BSF), and supervised over 40 graduate students, post-doctoral fellows and established scientists.

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