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How does nucleoid complexity affect cell dimensions during the division process in bacillary bacteria

Bacterial mass grows exponentially, whereas DNA replicates linearly during C≈40 min, at all growth rates. Replication is initiated at a constant cell mass, Mi per oriC; every mass doubling time (τ_m) and cell division occurs a constant time, D≈20 min after termination, hence cells are larger at faster growth in richer media. At fast growth, cell cycles overlap and replication is multi-forked. Bacilli such as *Escherichia coli* extend in length (L) only, but their constant width (W) is larger at faster growth or slower replication, in proportion to the nucleoid complexity (*NC*), related to the number of replication positions (n=C/τ_m). A set of old, puzzling observations of cell size and dimensions is qualitatively consistent with the view that branching results from breaching a maximum possible n (n_{max}), interpreted in terms of a minimal distance possible between successive moving replisomes called eclipse. The data analysis models the correlations to, (i) shed light on the necessary coupling between the only two unique structures in a bacterium, nucleoid and sacculus, and (ii) decipher the primary signal transduced from DNA to the peptidoglycan biosynthetic pathway in the divisome. The first approximation is not sufficient to account for the rate at which average cell size rises with time; additional causes are considered to reconcile this discrepancy: loss of division capacity of some DNA-less cells and dependence of *D* on *W*. A physical signal is invoked, related to transcription/translation of membrane protein genes coupled to membrane-insertion of these proteins termed "transertion".

Biography

Arieh Zaritsky obtained a distinguished MSc in Genetics at the Hebrew University, Israel in 1967. He completed his PhD from Leicester University, UK in 1971 and Post-doctorate at University Institute of Microbiology, Copenhagen, Denmark in 1972. During his career, he has instructed over 50 graduate students/scientists and was awarded numerous research grants. He visited higher education institutions around the world and delivered invited lectures at international meetings. He is a recognized expert in Bacterial and Bacteriophage Physiology, on which he has published about half of his 130 peer-reviewed articles, and was awarded (1994) Burroughs-Wellcome/ ASM Visiting Professorship.

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