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Research Paper

Metamorphosis of *Borrelia burgdorferi* organisms – RNA, lipid and protein composition in context with the spirochetes' shape

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Abstract

Borrelia burgdorferi, the agent of Lyme borreliosis, has the ability to undergo morphological transformation from a motile spirochetal to non-motile spherical shape when it encounters unfavorable conditions. However, little information is available on the mechanism that enables the bacterium to change its shape and whether major components of the cells – nucleic acids, proteins, lipids – are possibly modified during the process. Deducing from investigations utilizing electron microscopy, it seems that shape alteration begins with membrane budding followed by folding of the protoplasmatic cylinder inside the outer surface membrane. Scanning electron microscopy confirmed that a deficiency in producing functioning periplasmic flagella did not hinder sphere formation. Further, it was shown that the spirochetes' and spheres' lipid compositions were indistinguishable. Neither phosphatidylcholine nor phosphatidylglycerol were altered by the structural transformation. In addition, no changes in differential protein expression were detected during this process. However, minimal degradation of RNA and a reduced antigen-antibody binding activity were observed with advanced age of the spheres. The results of our comparisons and the failure to generate mutants lacking the ability to convert to spheres suggest that the metamorphosis of *B. burgdorferi* results in a conditional reconstruction of the outer membrane. The spheres, which appear to be more resistant to unfavorable conditions and exhibit reduced immune reactivity when compared to spirochetes, might allow the *B. burgdorferi* to escape complete clearance and possibly ensure long-term survival in the host. (© 2010 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim)

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