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Membrane properties of branched polyprenyl phosphates, postulated as primitive membrane constituents.

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Streszczenie

We have postulated earlier that the highly branched isoprenoid alkanes, which are distributed widely in many sediments, may have been derived from the corresponding branched polyprenyl phosphates, potentially present in biomembranes in primitive organisms. These polyprenyl-branched polyprenyl phosphates might be derived by a simple alkylation from non-substituted polyprenyl phosphates, which we postulate to be the precursors of all membrane terpenoids. We have now synthesized a series of 6-(poly)prenyl-substituted polyprenyl phosphates and studied the formation of vesicles from these phosphates, as a function of the substituted-chain length, the position of the double bond, and pH. Nine of the branched polyprenyl phosphates containing 20-30 C-atoms do form vesicles at a 'physiological' pH; the lipophilicity/hydrophilicity ratio is as expected an important factor. We have also studied the water permeability through membranes of these branched polyprenyl phosphate vesicles by our stopped-flow/light-scattering method. These highly branched polyprenyl phosphates can more effectively reduce the water permeability than non-substituted polyprenyl phosphates: the vesicles formed by the former are more stable against mechanical stress. This reinforces our hypothesis about the origin of the sedimentary polyprenyl-substituted polyprene hydrocarbons.

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