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Properties and Application of Enzymes for Bacterial Glycogen Biosynthesis and Degradation

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Structures and properties of enzymes for bacterial glycogen metabolism have been investigated. Branching enzyme (BE, EC 2.4.1.18), which is responsible for α-1,6 glucosidic linkages of glycogen, was found to catalyze cyclization of amylose. It was suggested that the ratio of branching to cyclization reactions is dependent on the size and concentration of substrate. We also demonstrated that the thermostable BE from *Bacillus stearothermophilus* efficiently catalyzes cyclization of B chains of amylopectin to produce highly-branched cyclic dextrin, Cluster Dextrin™. In spite of its high molecular weight and relatively long unit chains, Cluster Dextrin™ is highly soluble in water and shows characteristic properties for food and non-food applications. Moreover, glycogen-like polysaccharide with an extremely high molecular weight (>10,000,000) could be synthesized by using α-glucan phosphorylase with BE. Properties of other enzymes for glycogen metabolism are also described. Comparison of the primary structures of ADP-glucose pyrophosphorylases (AGPs) derived from genome projects and the experimental results using the enzyme from *B. stearothermophilus* suggest a remarkable variety of AGP.

Key words: branching enzyme, cyclization, dextrin, glycogen, ADP-glucose pyrophosphorylase