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Observing Chitooligosaccharide Traveling through a Biological Nanopore of Escheriachia coli

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Observing Chitooligosaccharide Traveling through a Biological Nanopore of Escheriachia coli
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Porins assembled inside the outer membrane of Gram-negative bacteria typically serve as molecular filters, allowing hydrophilic compounds to pass through by either general diffusion or facilitated diffusion process. Porins are composed of β-strands that lie in an antiparallel fashion and form a cylindrical tube, called a β-barrel, with overall dimension of 1-3 nm in diameter and 5 nm in height. In this report, we describe the identification and characterization of chitoporin, namely EcChiP, from Escherichia coli. Using black lipid membrane reconstitution (BLM) technique, we prove that EcChiP could readily form a stable nanopore in artificial phospholipid membranes, permitting an ion flow of average conductance of 0.55±0.01 nS. Together with bulk permeation study by liposome swelling assays, we demonstrate that EcChiP is a sugar-specific transporter, with pronounced specificity towards long-chain chitooligosaccharides. From physiological point of view, this study provides the first evidence that non-chitinolytic bacteria (here is E. coli) can exploit chitin degradation products as alternative energy supply to thrive under glucose-deficient conditions by expressing chitoporin as a molecular gateway for nutrient uptake.

Keywords: Biological nanopore; chitooligosaccharides; single channel conductance; sugar transporter

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