Synopsis of Original Research Paper

Elucidation of molecular mechanisms involved in the formation of tight junction

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Epithelial cells define the boundary between the outside and the inside of our body by constructing the diffusion barrier. Tight junctions (TJs) of epithelial cells function as barriers against invasion of harmful microorganisms into the human body and free diffusion of water or ions from the body. Therefore, formation of TJs has to be strictly controlled in epithelial cells. However, the molecular mechanisms governing this regulation are largely unknown. In this study, we identified Ca2+/calmodulin-dependent protein kinase II (CaMKII) as a regulator of the barrier function of TJs. CaMKII inhibition led to enlargement of TJ-areas and up-regulation of the barrier function. CaMKII inhibition induced excess TJ formation in part by the activation of AMP-activated protein kinase (AMPK) and subsequent phosphorylation of claudin-1. As up-regulation of epithelial barriers is essential for the prevention of chronic inflammatory diseases, the identification of CaMKII as a modulator of TJ function paves the way for the development of new drugs to treat these diseases.