High-resolution Crystal Structure of a Truncated ColE7 Translocation Domain: Implications for Colicin Transport Across Membranes

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ColE7 is a nuclease-type colicin released from Escherichia coli to kill sensitive bacterial cells by degrading the nucleic acid molecules in their cytoplasm. ColE7 is classified as one of the group A colicins, since the N-terminal translocation domain (T-domain) of the nuclease-type colicins interact with specific membrane-bound or periplasmic Tol proteins during protein import. Here, we show that if the N-terminal tail of ColE7 is deleted, ColE7 (residues 63–576) loses its bactericidal activity against E. coli. Moreover, TolB protein interacts directly with the T-domain of ColE7 (residues 1–316), but not with the N-terminal deleted T-domain (residues 60–316), as detected by co-immunoprecipitation experiments, confirming that the N-terminal tail is required for ColE7 interactions with TolB. The crystal structure of the N-terminal tail deleted ColE7 T-domain was determined by the multi-wavelength anomalous dispersion method at a resolution of 1.7 Å. The structure of the ColE7 T-domain superimposes well with the T-domain of ColE3 and TR-domain of ColB, a group A Tol-dependent colicin and a group B TonB-dependent colicin, respectively. The structural resemblance of group A and B colicins implies that the two groups of colicins may share a mechanistic connection during cellular import.

Crystal Structure of ColE7 Translocation Domain

| T-domain was then produced and crystallized. Three sets of X-ray diffraction data were collected using synchrotron radiation at different wavelengths at beamline NW12 in the KEK Photon Factory, Tsukuba, Japan. The structure was solved by the MAD method using anomalous signals from four Se-atoms. |