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Preliminary Crystallographic Study of the Bacterial Cell Division Protein MinC

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Introduction: Cell division in bacteria is a complex process. It begins with the formation of a ring of the protein FtsZ (a tubulin-like GTPase) at the future division site. This FtsZ ring then recruits a host of other cell division proteins to form a septasome, an organelle that facilitates the coordinated ingrowth of the inner membrane, murein cell wall, and outer membrane to ultimately form the division septum. In *E. coli*, as well as many other rod-shaped bacteria, the septum is normally placed at midcell, ensuring that each daughter cell receives a chromosome and equal portions of cytosolic components. However, potential division sites also exist at the cell poles, and placement of the septum at either of these sites results in the formation of nonviable, anucleate minicells, and short, multinucleate filaments. The high fidelity with which the septum is placed at the proper midcell division site is evidence of a stringent system governing the placement of the division septum. The three proteins of the minB operon, MinC (M_r 24.7kDa), MinD (M_r 29.6kDa) and MinE (M_r 10.2kDa), have been shown to be responsible for spatial regulation of septum formation by inhibiting septum formation at the aberrant polar division sites, while allowing septum formation at the midcell division site. MinC and MinD interact to form a potent division inhibitor capable of blocking septum formation at all possible division sites. It is believed that the MinC:MinD division inhibitor works by preventing formation of the FtsZ ring. MinE, a dimeric protein, localizes to the interior of the plasma membrane at midcell. Since MinE, is present only at midcell, it induces dissociation of the MinC:MinD complex only at midcell, thereby allowing formation of the FtsZ ring in the correct location. Structural studies of MinC, MinD, and MinE alone and in complex will provide valuable information on protein:protein interactions governing cell division.

Results: Preliminary X-ray crystallographic studies have been carried out on 0.05 x 0.05 x 0.3mm crystals of the C-terminal fragment of MinC (residues 118-231, M_r 12.8kDa) obtained from 0.3mM NaCl, 20mM TRIS buffer, pH 8.0, and 1mM Tris(2-carboxyethyl)phosphine (TCEP). The crystals are primitive hexagonal with dimensions $a=b=123.1$ $c=176.7$, $\alpha=\beta=90^\circ$, $\gamma=120^\circ$, and they diffract to better than 3.5Å resolution. Subsequent optimization of crystallization conditions has yielded larger crystals of the MinC C-terminal fragment.