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Structural study of a transporter X protein causing antibiotic resistance in gram-negative bacteria

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Antibiotics have had a tremendous impact on human medical technology and life expectancy. Since their discovery, many antibiotics have been developed and used in various fields, such as research, medicine, and animal husbandry. Beta-lactam antibiotics, which are derived from fungi in the Penicillium genus, are among the most commonly used antibiotics due to their ability to effectively inhibit the formation of microorganisms' peptidoglycan layer. However, the emergence of antibiotic-resistant strains has posed a threat to the "golden age" of antibiotic use. The rate of emergence of antibiotic-resistant bacteria has surpassed the rate of antibiotic development, and no new antibiotics have been approved since the early 2000s due to the significant challenges associated with antibiotic discovery. Recently, there have been reports of "super bacteria" that are resistant to carbapenem antibiotics containing beta-lactam structures, which has made antibiotic research an urgent need. The transporter X is a 14-transmembrane protein located in the inner membrane of Gram-negative bacteria that plays a critical role in the peptidoglycan cycle and the beta-lactamase signaling pathway of antibiotic-resistant bacteria. Our research objective is to identify the structure of transporter X and investigate its function. We also aim to develop "antibiotic adjuvants" by discovering and developing antagonists that can inhibit the function of transporter based on its structure. These inhibitors of the transporter X are expected to restore the effectiveness of beta-lactam antibiotics against previously resistant strains, making them susceptible to beta-lactam treatment. By reusing beta-lactam antibiotics through the use of these inhibitors, our research may contribute to combating antibiotic resistance.

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