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Antimicrobial Efflux Pumps

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8.1 Bacterial Antimicrobial Efflux Pumps

8.1.1 Active Drug Efflux Systems

Bacterial microorganisms that are causative agents of infectious disease in human and animal populations exploit two chief antimicrobial efflux systems that serve to extrude inhibitory antimicrobial solutes from their internal cellular milieu, effectively compromising the efficacy of clinical chemotherapy (Floyd et al. 2013; Kumar and Varela 2013). In general, active drug efflux proteins fall into two transporter types, known as primary and secondary active transport (Levy 2002). Both types of drug efflux systems consist of integral membrane transporter proteins that bind to antibacterial solutes and actively catalyze their translocation through the bacterial membrane in an outward direction. These active drug transporters serve the bacteria to reduce the intracellular concentrations of internally located inhibitory agents from the bacterial cell (Pu et al. 2017). In many cases, active drug efflux systems confer bacterial resistance to multiple antimicrobial drugs, producing a serious public health concern on a worldwide basis (Levy 2001).

8.1.1.1 Primary Active Drug Transporters

The first active drug efflux system is frequently referred to as primary active transport, and these systems take advantage of the biological energy stored in the form of adenosine 5'-triphosphate (ATP) and its associated hydrolysis to transport antimicrobial agents across the membrane to the extracellular location (Davidson and Maloney 2007). One well-studied primary drug efflux class consists of the highly related ATP-binding cassette (ABC) superfamily of transporters (Kathawala et al. 2015). In terms of overall structure, the ABC