

## Antimicrobial Resistance Gallery

### Efflux pumps

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#### Efflux Pumps: The Antibiotic Resistance Gatekeepers

Efflux pumps are specialized proteins found in the cell membranes of bacteria. These proteins actively remove harmful substances that enter the cell, including antibiotics, by pumping them out to the outside environment, like a bilge pump on a boat that removes water collecting at the bottom. Thus, efflux pumps are like doorkeepers in bacterial cells, which constitute a defense mechanism helping bacteria survive in the presence of antibiotics by pumping them out before they can do any damage.

Imagine a fortress (the bacterial cell) with guards (efflux pumps) stationed at the gates. When antibiotics (the enemy) attack the fortress, if they pass through the wall (the bacterial membrane) the guards will recognize them and swiftly pump them out, keeping the fortress safe and sound. This constant pumping prevents the antibiotics from reaching damaging concentrations inside the bacterial cell, rendering them ineffective (unable to conquer the fortress).

## A child-centric microbiology education framework

Efflux pumps play a crucial role in antibiotic resistance. Bacteria can become resistant to antibiotics by increasing the number of efflux pumps in their membranes or by modifying existing pumps to recognize and expel a broader range of antibiotics. This ability allows bacteria to survive even in the presence of high concentrations of antibiotics, making infections harder to treat, leading to longer illnesses and sometimes even more serious health problems.

*Understanding efflux pumps, the bacterial fortress gate keepers, is crucial in our fight against antibiotic-resistant bacteria*

By learning how efflux pumps work, scientists hope to find ways to outsmart them and develop better treatments for bacterial infections. These include designing inhibitors that can block the function of efflux pumps, developing new antibiotics that bacteria can't pump out so easily, or finding collateral weaknesses coming from overproducing efflux pumps that could be used against antibiotic-resistant bacteria.

Efflux pumps are essential components of bacterial defense mechanisms against antibiotics. By unraveling their secrets, we can develop effective strategies to combat this growing problem for better protecting ourselves against bacterial infections and ensure that antibiotics remain effective for generations to come.