Role of chitooligosaccharide-specific channel in aminoglycoside uptake by the opportunistic pathogen *Serratia marcescens*

Rawiporn Amornloetwattana [1] and Wipa Suginta [1,*]

[1] School of Biomolecular Science and Engineering (BSE), Vidyasirimedhi Institute of Science and Technology (VISTEC), Payubnai, Wangchan, Rayong, Thailand, 21210

* Correspondence: wipa.s@vistec.ac.th ;

Abstract: *Serratia marcescens* (*Sm*) is an opportunistic pathogen that is highly infectious to the immunocompromised patients. There are several reports of high antibiotic resistance rate against the first generation of β-lactam and cephalosporin antibiotics. The clinical practice report establishes that the use of aminoglycosides in combination with other types of antibiotics can decrease the resistance rate of this bacterium. Recent studies of chitin utilization in *Sm* showed that *Serratia spp.* can uptake chitin nutrients through a sugar-specific porin named chitoporin (*Sm*ChiP). All aminoglycosides contain three sugar rings in their backbone structures with different side chains. Therefore, the molecular uptake of these antibiotics is thought to be able to pass through sugar-specific porins, such as chitoporin. In this work, the aminoglycoside susceptibility of *Sm* was carried out based on the EUCAST standardize protocol. The results show that only gentamicin is in the susceptible range of MICs values (2 mg.mL^{-1}). Single channel recording experiments show that only gentamicin and kanamycin B strongly interact with the *Sm*ChiP channel. The fluctuation of current was observed only at the negative potential applied because of the positively-charged amine groups of gentamicin and kanamycin B. Docking gentamicin and kanamycin B into the pore interior of *Sm*ChiP showed that both antibiotics occupied the same constriction area with the known substrate, chitohexaose. Understanding antibiotics uptake through *Sm*ChiP can help to design new effective anti-microbial drugs against *Sm*.

Keywords: *Serratia marcescens*, Chitoporin, Aminoglycosides, Gentamicin, Kanamycin, Black Lipid Membrane (BLM), Molecular Docking

Funding: This research was full funded by Vidyasirimedhi Institute of Science and Technology (VISTEC), Thailand by the full-time Master scholarship to RA. WS was supported by Vidyasirimedhi Institute of Science and Technology and Thailand Research Fund through The Basic Research Grant (BRG610008) and Thailand Science Research and Innovation through Global Partnership Grant (Contract no: PMUB-P5-63-B20PIC_WIS_CHU-PMB010).

Institutional Review Board Statement: Not applicable

Informed Consent Statement: Not applicable

Data Availability Statement: All data contained in the article.

Acknowledgement: We received the experimental facilities and technical services from VISTEC.

Conflicts of Interest: The authors declare no conflict of interest.