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Membrane Proteomics has emerged as a Tool to Study Carbapenem Resistance in *Acinetobacter baumannii*

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Acinetobacter baumannii is one of the most important opportunistic pathogens described by Infectious Disease Society of America [1]. Due to its lethality, it is grouped into ESKAPE pathogens (group of hospital-acquired infection causing pathogens). Reports on the ESKAPE pathogen showed that more people now die in US due to the ESKAPE pathogen infections than of HIV/AIDS and tuberculosis combined [2,3]. *Acinetobacter baumannii* has emerged as a threat to soldiers, wounded during military operations in Iraq and Afghanistan [4,5] as well as isolated from natural resources [6]. It causes pneumonia, urinary tract infections and respiratory infections. *Acinetobacter baumannii* has ability to survive on artificial surfaces and utilize ethanol as a carbon source [7], resist desiccation, grow at various temperatures and pH conditions [8] this make it a notorious pathogen. Prevalence of *Acinetobacter baumannii* in clinical setup increases with time [9]. Carbapenems are most commonly prescribed β-lactam against *A. baumannii* [10]. Emergence of resistance against carbapenem is a significant health problem & associated with high morbidity & mortality [11] which makes it one of the major concerns [9,12,13].

Proteomics emerged as a tool to study the differential proteome under diverse conditions. Cytoplasmic proteins have often been used in proteomic studies. Membrane plays an important role in the survival of bacteria as it act as a barrier between bacterium and external environment inside the host. With the development of proteomics, a considerable progress has been made in the recent years in the field of membrane proteomics [14,15]. Prof. Vila group, Spain, first reported the membrane proteome of carbapenem resistance strain of *Acinetobacter baumannii* [16]. Similarly, Siroy et al. [17] also performed the global comparison of the membrane sub-proteomes of multidrug-resistant *Acinetobacter baumannii* strain and a reference strain. Membrane proteomics has been also employed for the study of the resistance mechanism for other drugs like colistin used against *A. baumannii* [18]. Using membrane proteomics approach, Soares et al. [19] showed that *Acinetobacter baumannii* displays a robust and versatile metabolism. With the help of outer membrane proteomics, Kwon et al. [20] studied the secretion of outer membrane vesicles (OMVs) from a clinical *A. baumannii* isolate and analysed the comprehensive proteome of *A. baumannii*-derived OMVs. Not only that high-end isoelectric point (pH 6-11) membrane proteome analysis of *Acinetobacter radioresistens* S-13 reveals that envelope stress responses can be induced by aromatic compounds [21]. Biofilm formation is one of the main causes for the persistence of *Acinetobacter baumannii* on the surface of host epithelial cells. Cabral et al. [22] performed proteomics of *Acinetobacter* cultured in three different conditions (exponential, late stationary phase and biofilms stage) and they also checked the effects of biofilm inhibitory compound (salicylate) on the biofilm formation. This multiple-approach strategy showed a unique lifestyle of *A. baumannii* involved in biofilms formation. Yun et al. [23] performed quantitative proteomic analysis of cell wall and plasma membrane fractions from multidrug-resistant *Acinetobacter baumannii* and reported that carbapenem induces the expression of resistance-nodulation-cell division transporters, protein kinases and suppress outer membrane proteins expression. Lee et al. [24] explain the mechanism of hetero-resistance induced by imipenem in the multidrug resistance *Acinetobacter baumannii*. Rajeswari et al [25] showed the importance of outer membrane in the carbapenem resistance using outer membrane proteomics of carbapenem resistance strain of *Acinetobacter baumannii*. Tiwari et al. [13] identified the importance of the metabolism in the carbapenem resistance of *Acinetobacter* using inner membrane proteomics. Role of iron in the survival of ATCC strain and carbapenem resistance strain of *Acinetobacter baumannii* in human host has also been studied using membrane proteomics [26,27].

These updates show that membrane proteomics has now emerged as an important tool to understand the mechanism of carbapenem resistance in *Acinetobacter baumannii*. Membrane proteomics also helps to understand the role of different environments/conditions in the survival of *Acinetobacter baumannii* and its adaptation as a notorious pathogen.

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