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# Variations in The Cell Wall Composition and Sequence Variation of The *mur*MN Operon of *Streptococcus pneumoniae* Strains of Different Susceptibility to Penicillin

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Penicillin resistance in *S. pneumoniae* is due to production of altered penicillin-binding proteins (PBPs), which are essential in cell wall synthesis. The pneumococcal peptidoglycan is composed of linear and branched muropeptides. It has been reported that the cell wall of the resistant strain has an abnormal chemical composition, indicating a structural difference of the muropeptides. In this study, we study the variation of the *mur*MN operon sequence and the cell wall composition of *S. pneumoniae* strains of different susceptibility to penicillin.

3 confirmed strains of *S. pneumoniae* (known MIC: Sensitive, Intermediate and resistant to Penicillin) were used. PCR amplification and sequencing of the *mur*M *and mur*N genes was carried out. Simultaneously, the bacterial cell wall of these strains was extracted and subjected to FTIR (Fourier Transfer Infrared Spectroscopy) and subsequently NMR (Nuclear Magnetic Resonance) analysis for further identification of the cell wall structure.

Sequencing of the *mur*M and *mur*N gene showed highly conserved with minimal sequence variation observed in the resistant strain. Eventhough, strains with various susceptibilities to penicillin had similar composition, the levels of transmittance differed between the sensitive and resistant strain, indicating difference in the individual molecule vibrational energy. Higher molecular vibration in the sensitive strain suggests a larger molecule mass, while branching of the cell wall structure in the resistance strain indicated decreased vibration of the chemical bonds within the molecule.

Penicillin resistance in *S. pneumoniae* is conferred by many contributing factors such as the variation of the penicillin binding proteins, the *mur*MN operon and the composition of the cell wall all, of which form part of the physical structure of the cell wall region. The variations in these factors causes modification in the cell wall structure, which may lead to decreased binding capacity to penicillins and other β-lactam drugs.