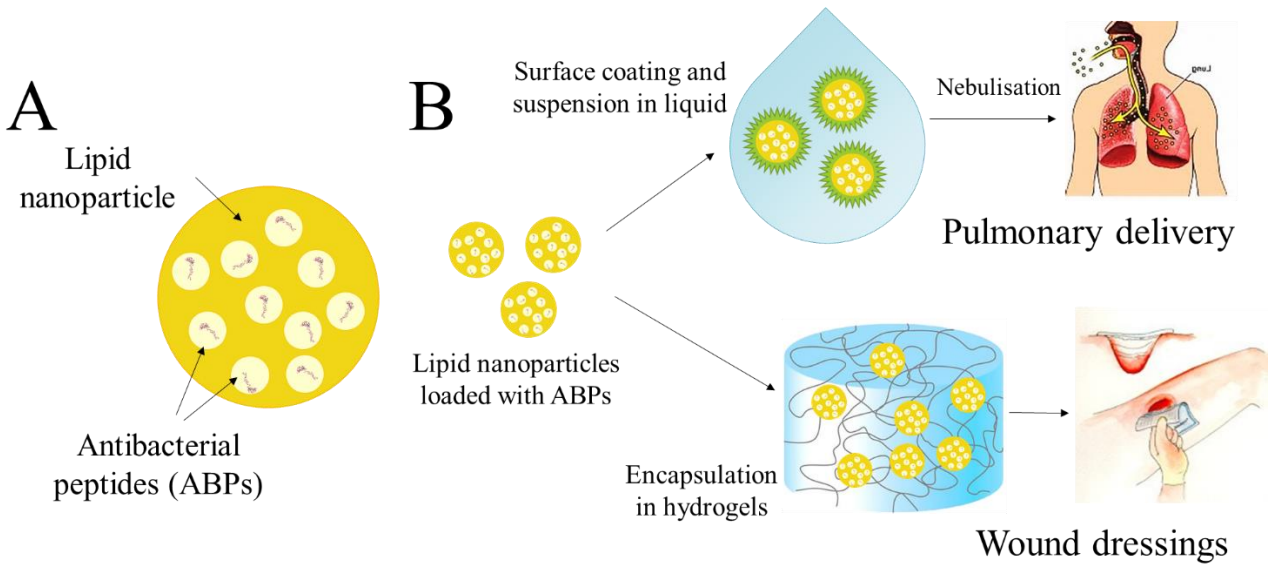
Lipid nanoparticles loaded with antibacterial peptides as an alternative treatment for bacterial infections

Every one of us carries around 2 kg of microbes (mostly bacteria) in digestive system and skin. They help us digest food or produce vitamins. But less than 1% of them can kill us – infectious bacterial strains such as *Pseudomonas aeruginosa* and *Staphylococcus aureus* cause life-threatening pulmonary infections, extensive abscesses or digestive diseases. Conventional treatment of bacterial infections is based on systemic administration of antibiotics (oral or intravenous). Although growth of bacteria can be effectively restrained by antibiotics, bacteria are not likely to surrender that easily. Bacteria with very short generation times (even about 20 minutes) and vast variety between species are able to develop resistance to antibiotics in little time. Now, it seems like antibiotics – one of the greatest discovery in medicine – are being overpowered by the bacteria and their ability to evolve.

Novel antibacterial therapies are being investigated extensively. Our attention was drawn to antibacterial peptides (ABPs) – cationic molecules consisting of 12-45 amino acids. ABPs are able to hamper bacterial proliferation as effectively as antibiotics, whereby bacteria are not able to develop resistance for ABPs. Although ABPs are regarded as a new generation of antibiotics and a good alternative for them, several issues must be solved before ABPs can be used in clinics. ABPs are obviously prone to inactivation by various proteolytic enzymes present in human body. Thus, t**he aim of the present study is to fabricate delivery carriers for ABPs protecting them from premature degradation and allowing their direct delivery to infected sites. We propose to use lipid nanoparticles as ABPs carriers, since lipids are non-toxic, can be used to encapsulate different types of molecules and are easily metabolized in human body. ABPs-loaded lipid nanoparticles will be further modified for specific administration routes which will improve their clinical efficacy.** For pulmonary delivery nanoparticles will be coated with muco-adhesive compounds and delivered via nebulisation. For the treatment of wound infections they will be entrapped in hydrogels and used as wound dressings. We hypothesise that **lipid nanoparticles loaded with ABPs can successfully overcome infections caused by antibiotic-resistant bacterial strains.**

The introduction of ABPs-loaded nanoparticles as a treatment option in clinics can potentially reduce the amount of conventional antibiotics used on a daily basis and prevent further evolution of bacterial resistance. It will improve quality of life for plenty of patients and decrease total costs of treatment.



Schematic representation of structure of lipid nanoparticles loaded with ABPs (A) and proposed methods for administration of such nanoparticles (B).