A Novel Response to Antibiotic Resistance: Application of Microparticles and AC Currents

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As antibiotic resistance becomes an increasing issue, the need for a non-antibiotic solution increases. Recent papers indicated that high frequency AC currents were safe and applicable in vivo to epithelial cells as a combatant of cancer. Unrelated papers detailed the high cost and unfeasibility of alternatives to antibiotics in both first and third world countries. One such treatment is bactericidal nanoparticles, harming human epithelial cells as well as bacterial cells by diffusion through both types of membranes. Thus, it was hypothesized that AC currents at high frequencies possess the capabilities to create ‘holes’ in bacterial membranes that allow for bactericidal elements such as microparticles to diffuse into the pathogen’s membrane in vivo, while leaving the thicker and sturdier epithelial cell membranes unharmed with holes too small for microparticles to diffuse through. The thin nature of the bacterial membrane is distinct from the thicker membrane of the epithelial cell, indicating that this procedure could specifically target and destroy bacteria in a manner that identifies human cell from bacterial. The results confirmed that application of microparticles by themselves produced 'super colonies' that had the largest area of all resultant colonies. These super colonies would likely be resistant to treatment. However, application of microparticles in combination with AC currents was significantly more bactericidal, with no resistant colonies formed, as determined by lack of large colony areas. These results show potential for a variety of treatments including tagging microparticles with antibiotics and diffusing them into the cell with little incentive for antibiotic resistance.