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Microorganism inactivation with Electric Pulses and Drugs

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Overuse of antibiotics in agriculture and healthcare has reduced the effectiveness of commonly used drugs for treating infections, motivating the development of methods to overcome antibiotic resistance to inactivate microorganisms. This study combines 300 ns electric pulses (EPs) with clinical and subclinical doses of drugs used to treat two common infectious bacteria, S. *aureus* and E. *coli*. We applied 20, 30 and 40 kV/cm, 300 ns EPs at 1 Hz with the number of EPs chosen to deliver the same energy density to 0.2, 2, and 20 μg/mL of tobramycin for 10 minutes of total drug exposure time. Applying 30 and 40 kV/cm EPs alone caused 2 to 4 log reduction; adding tobramycin induced a 7 to 9 log reduction. While this synergy occurred for smaller dosages with some antibiotics, it generally increased with larger doses. Minimal inactivation occurred with antibiotics alone over these timescales since these treatments typically require hours or days to effect cell kill off. These results indicate that combining EPs with drugs may potentially increase the effectiveness of drugs for treating local bacterial infections.

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