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Electrochemical Sensing of Antimicrobial Resistance

The development of resistance threatens the efficacy of available antibiotics, increasing the need for rapid clinical diagnosis of antimicrobial resistant infections. We propose to develop robust electrochemical sensors capable of differentiating between Gram-positive and Gram-negative species, as well as detecting molecular markers of antibiotic resistance in bacteria from each category. We propose three aims geared toward the design, construction, and implementation of these switch-OFF DNA sensors. In short, gold electrodes will be decorated with complementary hairpin DNA oligonucleotides that will be designed to accommodate a redox active molecule. The hairpin conformation ensures the redox active molecule is in close proximity to the electrode, thereby providing an ON signal. Upon target binding, the hairpin opens, releasing the redox active molecule from the electrode surface and in turn, decreasing the signal. This switch-OFF DNA sensor will be able to identify the presence of conserved Gram-positive and Gram-negative genetic sequences, as well as molecular indicators of drug resistance in *Staphylococcus aureus* and *Shigella* species. These sensors will provide rapid detection in under an hour as well as sensitivities comparable to quantitative PCR. This work also serves as a foundation for future multiplex antimicrobial resistance sensor diagnostics.