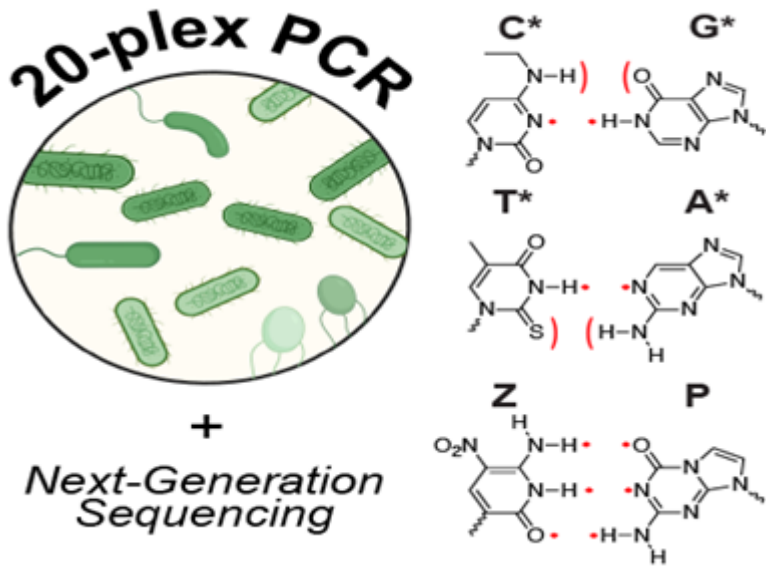
Highly Sensitive Multiplex Detection of Microbial Threats Using Non-Standard Nucleic Acids

A novel PCR-based icosaplex (20-plex) assay for detecting multiple microbial threats and antimicrobial resistance genes with high sensitivity and specificity.



Technology ID

BDP 8914

Category

Research Tools

Selection of Available Technologies

Diagnostic

Authors

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What is the Problem?

Emerging infectious diseases and the increasing prevalence of antibiotic resistance are significant threats to global public health. The wide variety of pathogens that can cause illness requires detection methods capable of identifying multiple genetic targets simultaneously. Environmental surveillance and clinical diagnostics often rely on polymerase chain reaction (PCR) methods to detect microbial threats. However, traditional PCR methods can struggle with sensitivity, specificity, and the ability to detect multiple targets simultaneously. This limitation poses challenges in accurately identifying and monitoring a growing list of microbial threats and antimicrobial resistance genes. There is a critical need for affordable, multi-target detection methods, especially in regions with high infectious disease burdens, limited resources, and diverse pathogen populations.

What is the Solution?

This innovation introduces a PCR-based icosaplex (20-plex) assay capable of detecting 18 enteropathogens and two antimicrobial resistance genes in a single test. The assay leverages the self-avoiding molecular recognition system (SAMRS) to prevent primer dimer formation and the artificially expanded genetic information system (AEGIS) to enhance amplification specificity. Next-generation sequencing is used for precise amplicon identification, making the assay highly sensitive and specific. The technology has been successfully benchmarked using a low-cost, portable sequencing platform on various sample types, including wastewater, soil, and human stool.

What is the Competitive Advantage?

Multiplex Capability: Detects up to 20 targets simultaneously, reducing the need for multiple tests.

High Sensitivity and Specificity: Utilizes SAMRS and AEGIS to enhance detection accuracy and prevent false positives.

Cost-Effective and Portable: Compatible with low-cost, portable sequencing platforms, making it accessible for field use.

Versatile Application: Suitable for environmental monitoring, wastewater-based epidemiology, and clinical diagnostics.

References

1. Kawabe, H., Manfio, L., Pena, S. M., Zhou, N. A., Bradley, K. M., Chen, C., McLendon, C., Benner, S. A., Levy, K., Yang, Z., Marchand, J. A., Fuhrmeister, E. R.(2025) , https://pmc.ncbi.nlm.nih.gov/articles/PMC11419210/, https://pubs.acs.org/journal/asbcd6, 14, 470-484